The FOUNDRY

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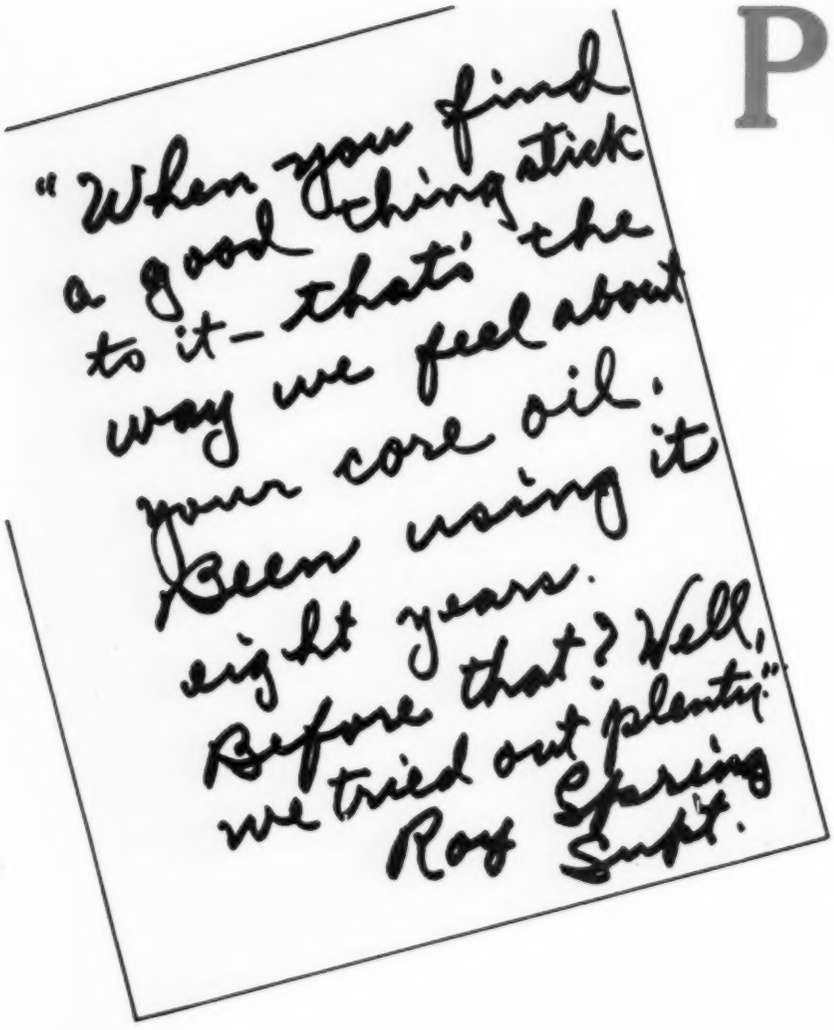

PROFIT

Find the oil, stick annoying

THE
RYBOLT
HEATER
COMPANY
Ashland, Ohio

Linoil cores are strong—there are no wire reinforcements in the big radiator cores on the opposite page and there always used to be. Linoil cores are porous enough to carry off the gas naturally and not through the wall of the casting. There are no soft spots where the metal eats in and runs wild, and there are no hard spots where the metal splutters and stews and makes scabby castings. The same mix does for the manifold cores and the big ones. And the clean-out is a pleasure to see. There are good reasons why Linoil is popular in busy foundries. Profit-making reasons.

THE WERNER G.

(DIVISION OF ARCHER -

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Editorial

Foundry Problems Increase as Production Gains

PROBLEMS facing the foundry industry continue to multiply, due in the main to a substantial improvement in the demand for castings, increases in the cost of raw materials, and an already apparent shortage of skilled workers, especially for executive positions. Contrary to the experience of a quarter century ago, the outbreak of the present war in Europe was followed by heavy purchases of castings for a wide variety of applications. Production of castings improved rapidly during September, and by the middle of October, when this was written, many foundries were operating at approximately the 1937 rate. Castings now being purchased are chiefly for domestic use.

Higher prices for raw materials naturally must result in increases in the selling prices of castings. Where foundries have been buying raw materials on the basis of immediate needs, such action is imperative. On the other hand, companies having extensive supplies purchased at lower prices should be privileged to benefit from intelligent management. When the present economic trend is reversed and prices decline, the foundry with a well stocked yard must take the loss in meeting competitive market prices for castings. Under all circumstances, prices for castings should be given the most careful consideration, and changes should be adopted on the bases of sanity and fairness. At the same time, needs of customers of long standing should not be neglected for what may appear to be greener fields in another pasture.

All of industry requiring a high degree of skill in manufacturing operations faces a serious shortage of trained men. As an indication of the immediate and future need, it is interesting to note that Massachusetts Institute of Technology has undertaken to organize its graduates to meet the new demand for technical personnel. President Karl T. Compton of M. I. T., in a recent letter to alumni of that institution, stated, "Since the war began in Europe, we have observed an increased demand for trained men, especially by industry. I am convinced this demand will continue to grow as our country adjusts itself to the new conditions imposed by the foreign conflict."

The foundry industry already is experiencing difficulty in finding men with sufficient knowledge and experience to handle certain highly specialized work. Inability to secure necessary manpower will extend all the way down the line if foundry production increases further to any marked extent. Where future possibilities indicate the need for technically trained men, they should be secured before the available supply is entirely exhausted. Skilled molders and other foundry operators can be obtained only through apprenticeship training, or by outbidding other companies for the services of their men. The latter method always is extremely expensive and seldom is satisfactory, for men, thus secured, constantly await the call of higher bidders. While no solution to the problem of the immediate future seems apparent, a long range view suggests that now is the time to dust off those plans for an apprenticeship training program, which, for one excuse or another, have lain dormant for many years.

One lesson of the 1914-18 era should be studied again by the entire industry. In the boom days of war demand, many new foundries were built and many additions were constructed to then existing plants. Some of these plants failed to produce a single casting and few profited sufficiently from the war business to pay for the heavy investments. For approximately ten years following the armistice, the foundry industry suffered from a tremendous excess of plant capacity which made profitable operation almost impossible. Unless plans for expansion have been under consideration for some time and are based upon normal requirements rather than on the present distorted situation, it seems rather sensible to believe that now is not the time to invest in bricks and mortar. The immediate problem pertains to equipment. Every consideration should be given to replacing obsolete machines with modern equipment, and to the further installation of equipment capable of improving practices and working conditions. Such a step will provide economies of operation and assist materially in solving the problem of skilled manpower. Modernization of existing plants also will increase the capacity of all four branches of the foundry industry sufficiently to meet demands considerably in excess of the present.

Frank G. Steinebach
Editor

Persons seeking employment fill out applications at this desk

Careful selection of men, unemployment insurance, group life insurance, employe's aid association, employe welfare, are a few of the employment manager's daily duties

Health and Safety

IN A MODERN F

Right—Applicants receive a thorough physical examination

Medical clerk secures applicant's past history record

Proper preliminary work and safety instruction with introduction to the plant originate in the interviewer's office

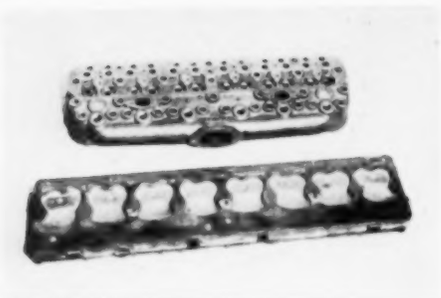
Employes awaiting examination or who have other appointments with the doctor wait in this room

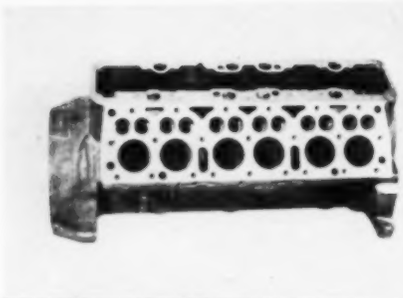
N F O U N D R Y

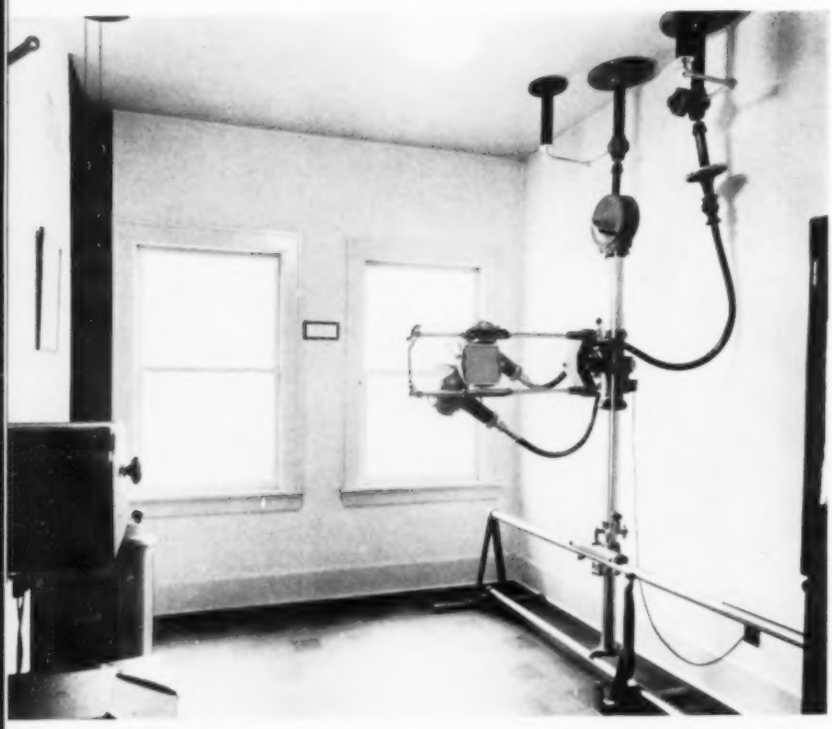
FOR many years the Campbell, Wyant & Cannon Foundry Co., Muskekon, Mich., has been a leader in furthering health and safety practices in its various foundries. Results attained should be gratifying, not only to Donald J. Campbell, Ira A. Wyant, and George W. Cannon, the three founders of the company, but to every executive and every workman in that large organization.

A short time ago, that company prepared a most interesting photographic record of over 75 prints, showing the various steps in the entire employe health program, and presenting some of the features of the safety work. Through the kind co-operation of the C.W.C. management, THE FOUNDRY has been privileged to select and reproduce approximately one-third of these photographs featuring safety and health.

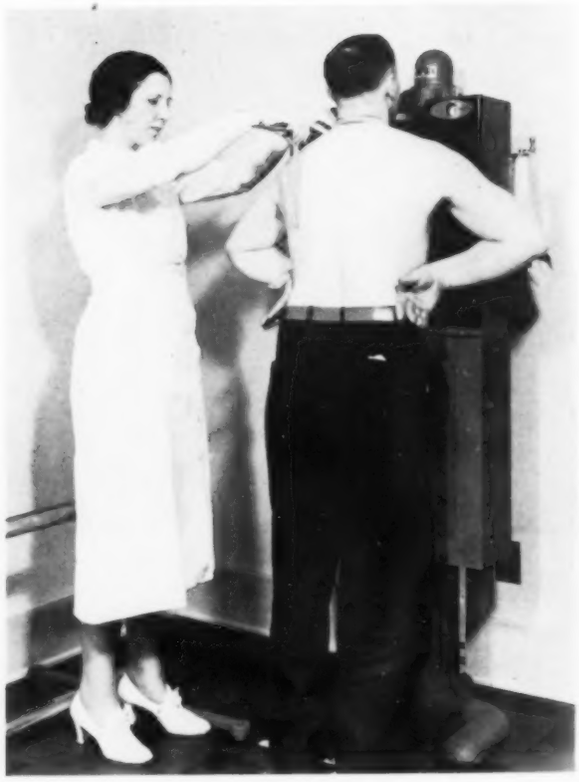
Taking blood sample for test. Below—Interior view of the medical building laboratory showing equipment







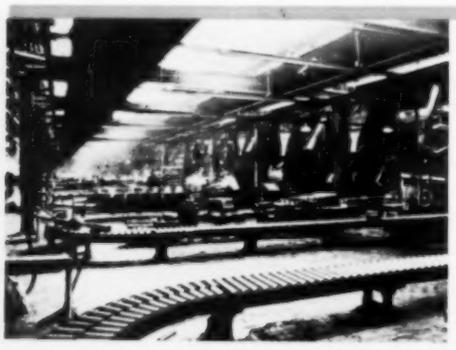
Necessary apparatus is installed in this room for conducting X-ray examination of the chest of beginners and for periodical examination later

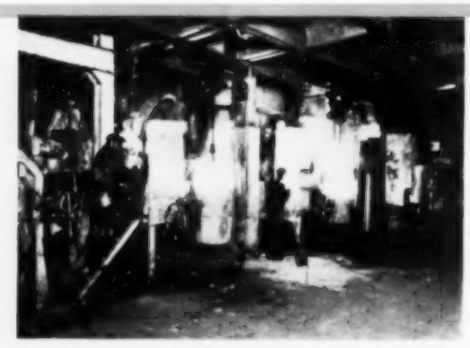


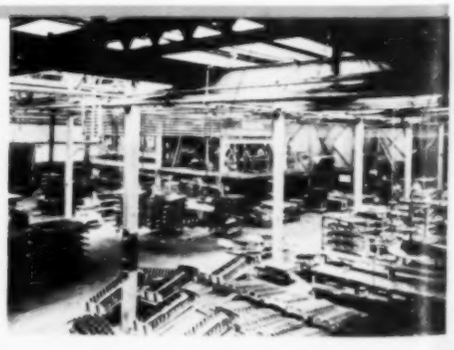
Technician placing patient in correct position for X-ray examination

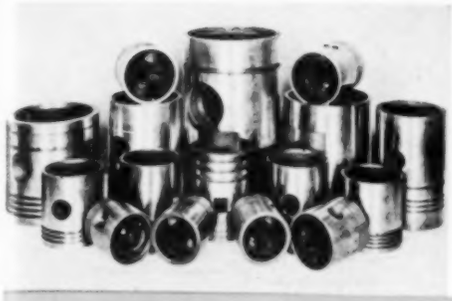
Interior view of completely equipped first aid department in plant No. 3

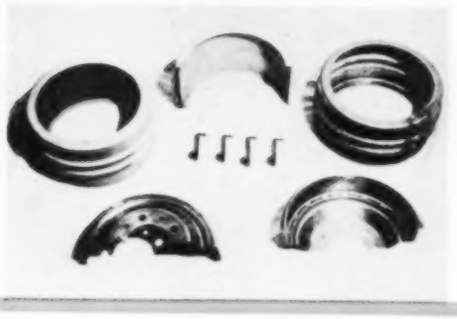
X-ray room and equipment located in first aid department

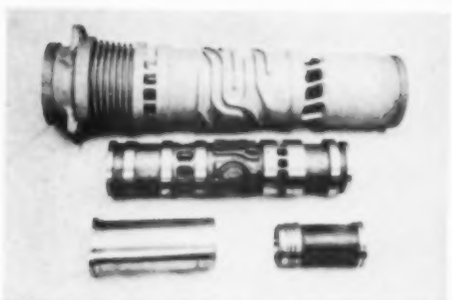












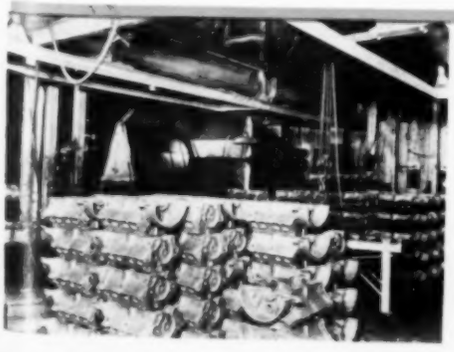
Doctors check results on chest X-ray examinations and dictate findings for permanent record

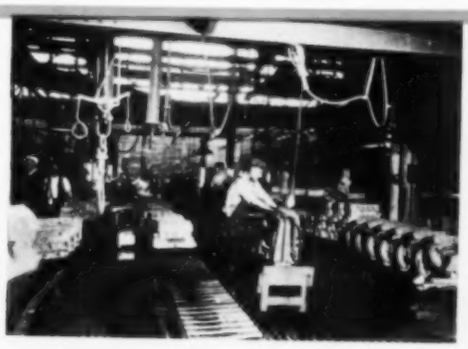
Health and Safety

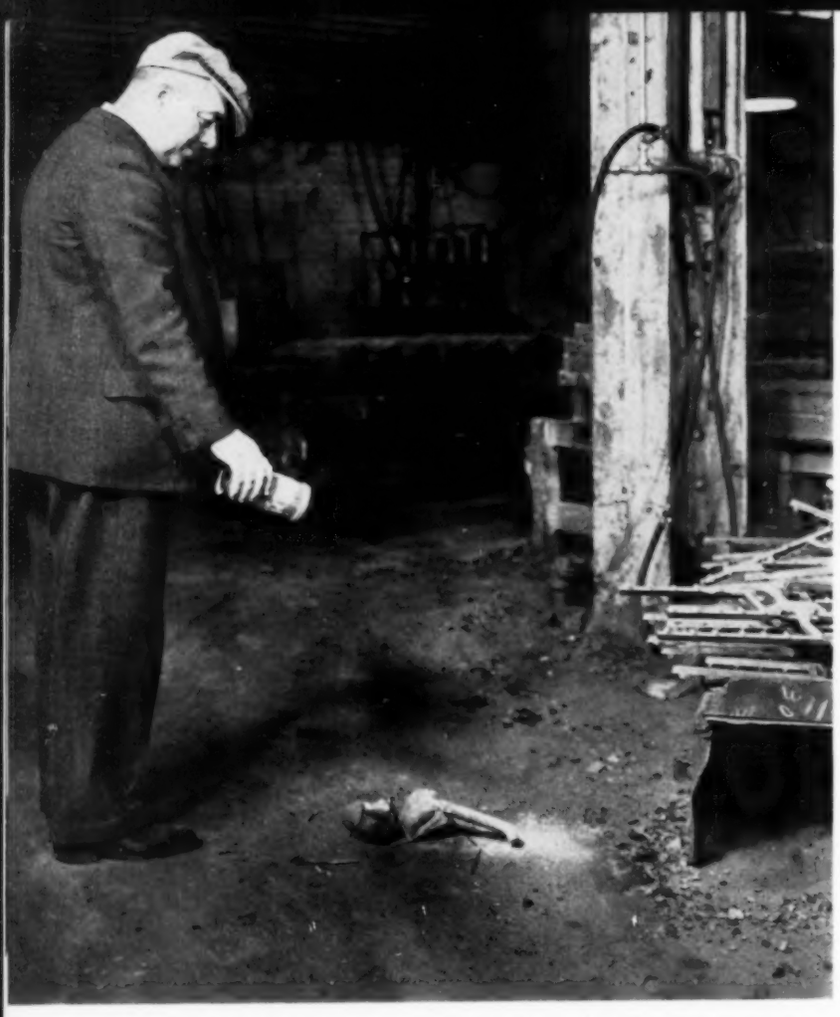
In the doctor's office the patient learns the result on various items of the medical examination

Nurse treating patient's eye, first aid department Plant No. 1

Visiting nurse convinces patients of need for family doctor's attention



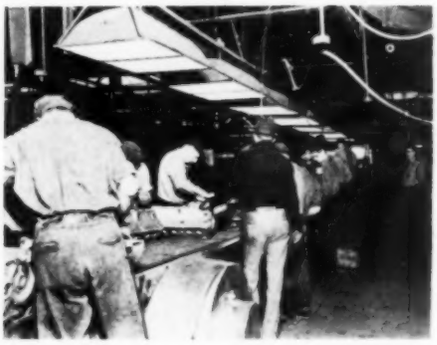




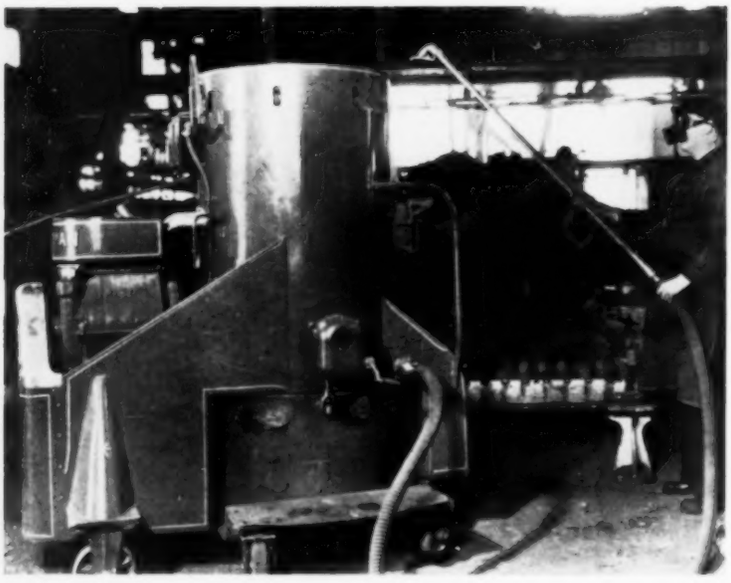
As an aid to safety promotion, the safety inspector scatters yellow calcimine dust on potential hazards

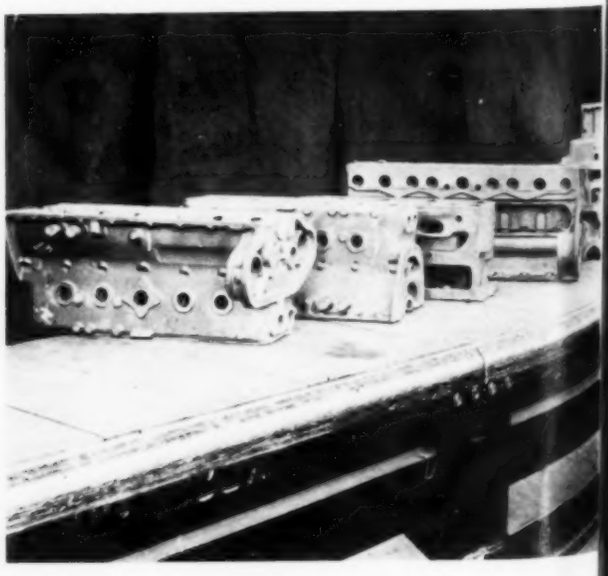
Good housekeeping bulletin boards are marked daily by safety inspector

Portable apparatus is employed to remove accumulation of dust, thus reducing exposure to worker

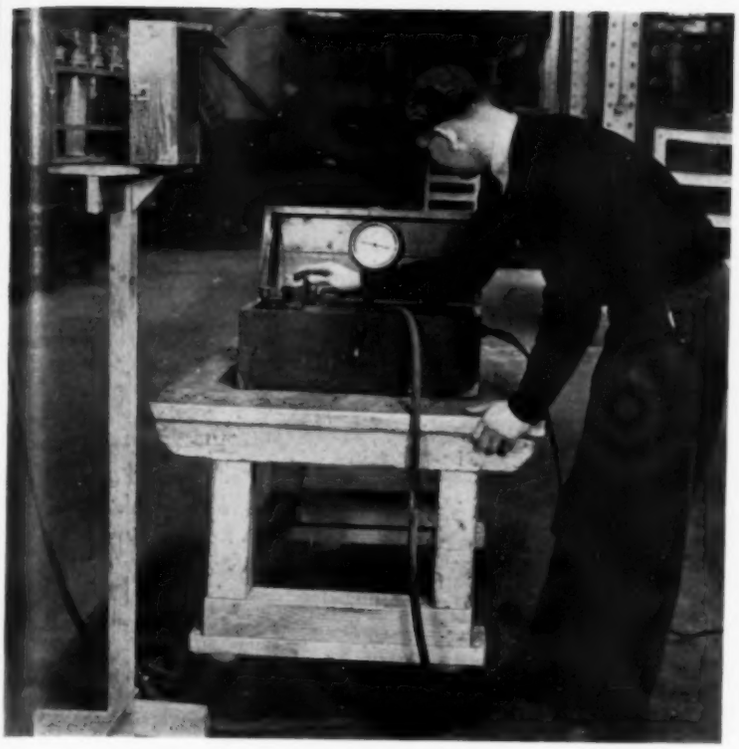


Daylight illumination is checked periodically with a light meter to see that lighting is satisfactory



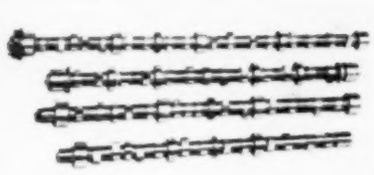


Health and Safety



Through suitable apparatus analytical chemist takes air samples in core room for dust count

Suction hood over the shakeout catches and removes the dust during that operation



Right—Plant manager and personnel manager check safety records for 1938 and 1939

How Large IS THE FOUNDRY I

By GEORGE POPE
Assistant Advertising Manager
The Foundry, Cleveland

ONE billion dollars is $1,000,000,000.

If you are able to imagine what that amount of money must look like or what it represents, running as it does into ten rather substantial figures, then you will have a general idea of the foundry industry's annual contribution to this country's national wealth. The total value of foundry production will run in excess of that amount in a year of operation at 50 per cent of capacity, according to recent compilations of THE FOUNDRY.

Statistics, as such, can be and often are tiresome if not confusing, yet to many foundrymen some of the highlights from this study of the foundry industry may be of interest. Among other facts brought out by the final report are these totals regarding foundries in the United States and Canada:

Total Foundries	5,233
Melting Units Operated	16,781
Annual Melting Capacity	25,869,000 tons
Annual Castings Capacity	16,892,000 tons
Average Castings Production	8,446,000 tons
Value of Production	$1,193,677,000

Table I

Foundry Industry Statistics

Annual melting capacity	
Gray Iron	17,238,850 tons
Nonferrous	2,547,925 tons
Malleable	2,680,725 tons
Steel	3,401,500 tons
TOTAL	25,869,000 tons
Annual castings capacity	
Gray Iron	12,067,200 tons
Nonferrous	1,783,550 tons
Malleable	1,340,400 tons
Steel	1,700,750 tons
TOTAL	16,891,900 tons
ESTIMATED AVERAGE* ANNUAL PRODUCTION OF CASTINGS	
Gray Iron	6,033,600 tons
Nonferrous	891,775 tons
Malleable	670,200 tons
Steel	850,375 tons
TOTAL	8,445,950 tons

* Based upon foundry operations at 50 per cent of capacity.

If you are a foundryman, it is quite likely that you, or one of your associates, supplied some of the information which made this study possible. Your co-operation in answering questions asked you by the editors of *Penton's Foundry List* (the biennial census of the foundry industry compiled by the publishers of THE FOUNDRY) in part, at least, provided the basis for arriving at many interesting facts regarding the foundry industry.

Based on 50 Per Cent of Capacity

You indicated, for instance, the rated capacity of the different types of melting units operated in your respective foundries. This enabled THE FOUNDRY to gage the tonnage of metal which all known units in the foundry industry would yield if operation were carried on at full capacity for a 12 months' period—25,869,000 tons annual melting capacity. By estimating carefully the return of good castings for different types of metal poured, it was ascertained that the foundry industry has a rated *castings capacity* of 16,891,900 tons annually. This assumes operation at 100 per cent of capacity under normal conditions, which would, of course, be anything but normal. For that reason, it seemed worthwhile to attempt an estimate of castings production in what might be termed an "average year"—one middle way between a "good" and a "poor" foundry year. With this in mind, 50 per cent of capacity operation was assumed, and as subsequent comparisons were to show, the resulting statistics were not far off on the basis of known production, for instance, of malleable and steel foundries. Thus, "average annual production" of castings was found to be approximately 8,500,000 tons. Table I gives those estimates for the four branches of the industry.

Of particular interest to some readers will be the tabulation of leading foundry states on a basis of melting capacity. Pennsylvania and Ohio which are first and second, respectively, in number of foundries are first and second likewise in total melting capacity. Michigan, however, stands in third place in melting capacity while only fifth in number of foundries. As a matter of fact, Michigan very nearly and to all intents and purposes actually ties with Ohio for second place in capacity. The most pronounced rise in position, however, is reserved for Alabama which,

Y INDUSTRY?

while standing in fifteenth place in number of foundries, actually rates sixth position among foundry states when melting capacity is considered. The same thing, to a lesser degree, is true of several other states. Canadian readers will find interest in the fact that the province of Ontario is exceeded in melting capacity only by six states and in number of foundries by five states. The second largest Canadian foundry province is Quebec which would stand seventeenth if leading foundry states and provinces were compared.

Value of Foundry Products Estimated

If it were possible to tabulate the *actual* production of castings from year to year and to know the value of foundry production by states, further significant changes would likely appear to change the standings as shown in Table II. However, it is believed that for most purposes existing melting capacity reflects comparative standings of the states with reasonable accuracy.

Because the annual value of foundry production is both an interesting and worthwhile figure to have, THE FOUNDRY undertook to study carefully ways and means of arriving at conclusions on that point. The department of commerce has, for many years, compiled data showing the value of production for the metals and metalworking industries but in its findings little, if any, information obtains so far as the foundry industry as a whole is concerned.

Accordingly, having arrived at what seemed to be a reasonable estimate of average annual castings production, THE FOUNDRY undertook to prepare a comparable estimate on the value of that production, including castings made both for own use and for resale. As shown in Table III, the total value of foundry production in a year of 50 per cent of capacity operation is seen to be well in excess of one billion dollars—$1,193,677,300 to be precise, (*Please turn to page* 94)

Table II

Analysis of Melting Capacity

UNITED STATES

State	Tons Annual Melting Capacity	Rank	No. of Foundries	Rank
Pennsylvania	3,745,800	1	560	1
Ohio	2,812,600	2	511	2
Michigan	2,789,000	3	313	5
Illinois	2,172,800	4	369	4
New York	1,957,000	5	393	3
Alabama	1,102,200	6	88	15
Wisconsin	1,045,200	7	202	8
Indiana	1,034,800	8	199	9
Massachusetts	875,800	9	213	7
New Jersey	661,000	10	177	10
California	592,600	11	274	6
Missouri	527,200	12	113	12
Connecticut	472,400	13	125	11
Iowa	359,600	14	76	17
Tennessee	357,600	15	66	19
Virginia	314,400	16	72	18
Minnesota	288,200	17	95	14
New Hampshire	245,600	18	27	32
Texas	240,200	19	96	13
Washington	233,800	20	80	16
Maryland	218,000	21	52	22
West Virginia	166,600	22	41	25
Georgia	163,600	23	64	20
Kentucky	139,400	24	39	26
Kansas	126,200	25	52	22
Rhode Island	123,600	26	33	28
Delaware	122,000	27	11	37
North Carolina	117,000	28	63	21
Colorado	111,000	29	45	24
Oregon	99,000	30	50	23
Maine	92,400	31	28	31
Louisiana	79,400	32	29	30
Vermont	74,400	33	20	33
Florida	59,000	34	31	29
Oklahoma	56,800	35	35	27
Nebraska	51,800	36	28	31
Utah	48,000	37	16	35
Arizona	36,400	38	6	39
Arkansas	34,400	39	19	34
South Carolina	32,400	40	20	33
Mississippi	27,800	41	12	36
Montana	23,200	42	7	38
Idaho	12,200	43	7	38
Nevada	10,800	44	6	39
South Dakota	10,700	45	3	41
Dis. of Columbia	6,400	46	3	41
North Dakota	4,200	47	5	40
New Mexico	2,000	48	1	42
Wyoming	100	49	1	42
Total U. S.	23,876,600 tons		4776	

CANADA

Province	Tons Annual Melting Capacity	Rank	No. of Foundries	Rank
Ontario	1,101,800	1	260	1
Quebec	328,700	2	86	2
Nova Scotia	296,700	3	22	4
British Columbia	112,100	4	41	3
Manitoba	74,400	5	14	5
New Brunswick	35,000	6	10	7
Calgary	22,800	7	13	6
Newfoundland	8,000	8	3	9
Saskatchawan	6,400	9	5	8
Prince Edward Island	2,800	10	3	9
Total Canada	1,992,400 tons		457	
Total U. S. and Canada	25,869,000 tons		5233	

Table III

Average Annual Production

	Estimated Castings Production		Estimated Value of Production	
	United States Tons	U. S. and Canada Tons	United States	U. S. and Canada
Gray Iron	5,606,250	6,033,600	$504,562,050	$543,023,850
Nonferrous	831,175	891,775	374,031,100	401,300,200
Malleable	626,775	670,200	94,016,250	100,527,600
Steel	744,225	850,375	130,239,400	148,825,650
	7,808,425	8,445,950	$1,102,848,800	$1,193,677,300

PROBABLY one of the earliest attempts to study castability was noting how oxide film breaks on the surface of molten metal. This oxide film is caused mainly by oxygen in the air coming in contact with the molten iron. Agitation of the molten iron under the skin, causes the skin to break into cracks and patches. By closely studying the way in which the film breaks, some molders, cupola, and ladle men develop an almost incredible accuracy in predicting the castability of the metal.

Steel foundrymen take advantage of this film play in a simple test that gives them quite an accurate index of castability. They pour a few pounds of steel into an open, cup-shaped, dry sand mold and clock the time it takes for the film play to stop—that is, until the metal scums over. A similar test possibly might be applied to cast iron, both unalloyed and alloyed, as an added tool for the measure of castability.

Alloys Affect Castability

Accurate fluidity tests have been one of the greatest helps in the study of castability. Unfortunately, we have not yet made systematic studies of the effect of alloying elements on castability. Most of the remarks that follow are not based on any quantitative tests on the effect of alloys on castability, but are rather observations on the appearance of metal and castings that have been alloyed.

In considering the castability of alloy irons, the melting point of ferroalloys and elements used in the alloying is an important factor. Following list shows the melting point data—degrees Fahr.— on the principal alloys used in cast iron: Electrolytic nickel, 2640; nickel F shot, 2300; ferrochromium, 2300 to 2600, depending on the grade; ferromolybdenum, 2800 to 2850; ferrovanadium, 2600 to 2700; copper, 1980; ferromanganese, 2280 to 2325; ferrosilicon, approximately 2450; ferrophosphorus, 2300; sulphur, 2150, (iron pyrites); ferrotungsten, (80 per cent tungsten, 1 per cent carbon) 3300.

The melting point is not nearly so important as the rate of solution, insofar as iron and steel foundry practice is concerned. Years ago, difficulty occasionally was encountered by gray iron foundrymen when the standard grade of ferrochromium—the steelmaking grade—was used in the ladle. Containing 68 to 72 per cent chromium and approximately 6 per cent carbon, that alloy, was perfectly satisfactory for steel foundry work or for iron foundry so long as the ferrochromium additions were made to the furnace proper. However, when additions of that ferroalloy were made to ladles, care had to be taken that thorough solution was obtained.

To make that ferroalloy more acceptable to the iron foundryman, the composition was modified to give more ready solution. A special foundry grade of ferrochromium now produced especially for the cast iron foundryman goes into solution a great deal faster than the standard high carbon chrome.

Nickel Does Not Affect Castability

To have some means of division, we are considering low alloys as irons containing under 1.50 per cent of alloy, and only elements other than those usually present, such as, carbon, manganese, silicon, etc., are considered alloying elements. Nickel in the low ranges, 1.5 per cent and under, appears to have very little effect on castability.

There seem to be some conflicting opinions in so far as molybdenum is concerned. By remelting molybdenum bearing pig iron, Hurst investigated the properties of molybdenum cast iron with the molybdenum ranging up to 3.50 per cent. He reported that all alloys as melted were quite fluid and ran freely. The author worked on the effect of molybdenum in cast iron some years ago and did not notice that molybdenum had any effect on castability, even with as high a percentage as 4.40 per cent molybdenum.

C. O. Burgess,[1] investigating the effects of chromium in cast iron, noted that chromium, when used in amounts up to 0.9 per cent seemed to have no effect on fluidity when casting transverse bars, fittings, 2-inch elbows, and plates. Wickenden and Vanick,[2] in working with nickel-chromium irons, reported no observable difference in fluidity up to 0.50 per cent chromium. So long as the chromium percentage is 1 per cent or under, no special precaution as to size of gates or risers, pouring speed, and the like, need be taken. With chromium as high as 1.68 per cent, Jennings[3] reported decreased fluidity in ⅛-inch sections.

While bismuth is not used as an alloying element, it is mentioned because the results are of peculiar interest. In work[4] done several years ago on bismuth treated irons, it was interesting to note that small additions decidedly improve the life of the metal. The added fluidity was attributed to a possible de-

Castability OF IRON

By
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oxidizing action of bismuth. Additions of bismuth to cast iron are not recommended since that element greatly lowers the mechanical properties of the iron. The bismuth treated iron was so rotten looking in fracture and so open grained that it was thought that it might make a good cast iron for hand grenades, where fragmentation is desirable.

One or two investigators state that copper has no appreciable effect on the fluidity of cast iron, but most others are fairly well agreed that copper additions have a beneficial effect[5]. One alloy cited quite often is the 1.50 per cent carbon, 2 per cent copper steels that are extensively made today and are stated to be very fluid.[6] Small percentages of vanadium seem to have no effect on castability.

All the foregoing remarks on the effect of alloys on castability infer that the alloys were added to the furnace. We cannot make a blanket statement that castability is affected this way or that by the addition of alloys. A statement must be made on how the alloys were added. In this discussion, we are mentioning three procedures: Furnace additions, ladle additions, and spout additions.

Furnace additions make use of the alloys in pig or lump forms or briquets, and wherever possible alloys should be added to the furnace proper. There are several reasons for this, but one of the most important is the saving of temperature, with resultant better fluidity.

The second procedure, (*Please turn to page* 104)

AVERAGES VS. MEASURED

By ALBERT E. GROVER
Cost Consultant

THE story is told of a traveler whose route compelled him to cross a river. There being no bridge, he approached a boatman to row him across. While negotiating with the boatman, a bystander informed him that the average depth of the river was 2½ feet. Attempting to save the cost of the boatman, he started across on foot, drowning himself in the attempt.

So it is with the foundryman who attempts to save the cost of a clerk by using averages of *unrelated facts* in calculating costs of individual jobs. In the jobbing foundry producing a variety of shapes and sizes the use of these averages increases the cost figure of jobs difficult to make, thus setting the stage for refusing the profitable jobs and accepting the unprofitable ones.

On the other hand quotations based on measured costs of tooling, melting, coremaking, molding and cleaning will guide the foundryman in deciding which jobs to take and which to refuse.

To show the use of averages of unrelated cost facts does not give the same answer as is obtained by measuring the individual costs of the several operations performed, the following data is presented: Table I, Metal Cost; Table II, Core making Cost; Table III, Molding Cost; Table IV, Cleaning Cost; Table V, Conversion Cost.

The data for these tables was taken from an actual day's performance of a small jobbing foundry producing both light and heavy work.

Table I shows the cost of metal at the spout when actual weights and values of gates and sprues for each pattern are considered. These costs per pound are shown under the general heading, "Measured." For the purpose of comparison, the average cost per pound is placed immediately to the right of the measured total cost per pound for each job.

Although the inaccuracy obtained by averaging metal costs is not as marked as when using averages in coremaking, molding and cleaning, it is of sufficient importance to consider when estimating sizable jobs.

Although the several patterns included in this day's work do show some regularity in per-

Table I

Cost of the Metal

	MEASURED								Cost per 100 pounds
	— MELTED —		— RETURNS —			—GOOD CASTINGS—			
PAT NO.	Pounds	Cost	Pounds	Value	LOSS	Pounds	Cost	Cost per lb.	Averaged
1	125	$1.37	55	$ .44	10	60	$ .93	.016	.014
2	80	.88	38	.30	6	36	.58	.016	.014
3	80	.88	34	.27	6	40	.61	.015	.014
4	100	1.10	46	.37	8	46	.73	.016	.014
5	1,400	15.35	273	2.18	112	1,015	13.17	.013	.014
6	2,700	29.61	1,006	8.04	206	1,488	21.57	.015	.014
7	300	3.30	48	.38	24	228	2.92	.013	.014
8	300	3.30	79	.63	24	197	2.67	.014	.014
9	1,100	12.00	282	2.26	88	730	9.74	.013	.014
10	1,188	13.03	566	4.53	94	528	8.50	.016	.014
11	300	3.30	86	.69	24	190	2.61	.014	.014
12	1,300	14.26	466	3.73	104	730	10.53	.014	.014
13	56	.61	20	.16	4	32	.45	.014	.014
14	55	.60	21	.17	4	30	.43	.014	.014
15	455	4.99	90	.72	36	329	4.27	.013	.014
16	1,950	21.38	372	2.98	156	1,422	18.40	.013	.014
17	16	.18	7	.06	1	8	.12	.015	.014
18	245	2.69	121	.97	19	105	1.72	.016	.014
19	1,400	15.35	413	3.30	112	875	12.05	.014	.014
20	77	.84	22	.18	6	49	.66	.014	.014
21	360	3.95	160	1.28	28	172	2.67	.016	.014
22	56	.61	24	.19	4	28	.42	.015	.014
23	28	.31	15	.12	2	11	.19	.018	.014
24	350	3.84	97	.78	28	225	3.06	.014	.014
25	80	.88	34	.27	6	40	.61	.015	.014
26	2,500	27.50	554	4.43	200	1,746	23.07	.013	.014
27	180	1.97	76	.62	14	90	1.35	.015	.014
28	72	.80	18	.14	6	48	.66	.014	.014
29	500	5.50	170	1.35	40	290	4.15	.014	.014
30	70	.77	30	.24	6	34	.53	.016	.014
31	9	.10	2	.02	1	6	.08	.013	.014
32	60	.66	29	.23	5	26	.43	.017	.014
33	5	.05	3	.02	..	2	.03	.015	.014
34	12	.13	5	.04	1	6	.09	.015	.014
35	37	.37	8	.06	2	27	.31	.010	.014
36	35	.39	14	.11	3	18	.28	.016	.014
	17,581	$192.85	5,284	$42.26	1,390	10,907	$150.59	.014	.014

8,791	87.91	Pig Iron @ $1.00 per cwt.
8,790	48.95	Scrap @ .50 per cwt.
	136.86	
	20.99	Melting Labor
	35.00	Melting Overhead
	192.85	

FACTS IN FOUNDRY COSTING

centage of returns and loss to metal melted, there might be other days when there would be patterns requiring exceptional gating. In that case the use of average cost per pound on hundred weight must be taken into consideration. An example is found in the case of extremely light castings gated for production in large quantities. There might also be heavy castings requiring very light sprues. Although some gray iron foundry apparently might run as this one did on the day the data was secured, the intelligent estimation of metal cost is predicated on measuring the expected result, and the cost system must be so arranged that facts are reflected in the cost of the job.

Table II shows the variance in costs for each job by distributing overhead on the basis of direct labor and direct labor hours. These variances usually are more pronounced where premium or piece rate methods are employed as increased earnings due to the method of wage payment does not increase proportionately to some of the overhead costs.

Found- (*Please turn to page* 90)

Table II

Core Making Cost

PAT. NO.	O. H DISTRIBUTED ON TIME Time	Wage Rate	Direct Labor	O. H.	Total Cost	O. H. DIST. AS PER CENT LABOR Labor	O. H.	Total Cost	VARIANCE
1	2.1	.55	1.16	2.65	3.81	1.16	1.80	2.96	—.85
2	none								
3	none								
4	.7	.70	.49	.88	1.37	.49	.82	1.31	—.06
5	4.8	.75	3.60	6.00	9.60	3.60	6.00	9.60	
6	5.2	.85	4.42	6.50	10.92	4.42	7.40	11.82	+.90
7	2.0	.75	1.50	2.56	4.06	1.50	2.50	4.00	—.06
8	.9	.65	.59	1.12	1.71	.59	.99	1.58	—.13
9	5.6	.75	4.20	7.00	11.20	4.20	7.16	11.36	+.16
10	none								
11	1.9	.55	1.05	2.38	3.43	1.05	1.76	2.81	—.62
12	.8	.65	.52	1.00	1.52	.52	.87	1.39	—.13
13	.2	.75	.15	.25	.40	.15	.25	.40	
14	none								
15	2.3	.85	1.96	2.88	4.84	1.96	3.28	5.24	+.40
16	.2	.75	.15	.25	.40	.15	.25	.40	
17	none								
18	.8	.70	.56	1.00	1.56	.56	.93	1.49	—.07
19	.6	.70	.42	.75	1 17	.42	.70	1.12	—.05
20	1.0	.65	.65	1.25	1.90	.65	1.11	1.76	—.14
21	2.2	.65	1.43	2.75	4.18	1.43	2.40	3.83	—.35
22	.5	.75	.38	.62	1.00	.38	.64	1.02	+.02
23	.5	.75	.38	.62	1.00	.38	.64	1.02	+.02
24	.4	.75	.30	.50	.80	.30	.50	.80	
25	none								
26	1.0	.80	.80	1.28	2.08	.80	1.34	2.14	+.06
27	5.2	.75	4.42	6.50	10.92	4.42	7.40	11.82	+.90
28	none								
29	.2	.75	.15	.25	.40	.15	.25	.40	
30	none								
31	none								
32	none								
33	none								
34	none								
35	none								
36	none								
	39.1		29.28	48.99	78.27	29.28	48.99	78.27	none

Table III

Foundry Molding Cost

PAT. NO.	O. H. DISTRIBUTED ON TIME Time	Wage Rate	Direct Labor	O.H.	Total	O. H. DISTRIBUTED ON PER CENT OF DIRECT LABOR Direct Labor	O.H.	Total	VARIANCE
1	4.7	.80	3.76	4.70	8.46	3.76	5.00	8.76	+ .30
2	.9	.80	.72	.90	1.62	.72	.96	1.68	+ .06
3	.9	.80	.72	.90	1.62	.72	.96	1.68	+ .06
4	1.0	.80	.80	1.00	1.80	.80	1.08	1.88	+ .08
5	7.5	.80	6.00	7.50	13.50	6.00	8.00	14.00	+ .50
6	4.2	.90	3.78	4.20	7.98	3.78	5.01	8.79	+ .81
7	8.0	.90	7.20	8.00	15.20	7.20	9.60	16.80	+1.60
8	2.0	.85	1.70	2.00	3.70	1.70	2.26	3.96	+ .26
9	5.8	.75	4.35	5.80	10.15	4.35	5.80	10.15	
10	6.6	.65	4.29	6.60	10.89	4.29	5.70	9.99	— .90
11	8.0	.80	6.40	8.00	14.40	6.40	8.55	14.95	+ .55
12	5.7	.65	3.71	5.70	9.41	3.71	4.95	8.66	— .75
13	.5	.65	.33	.50	.83	.33	.44	.77	— .06
14	1.5	.75	1 13	1.50	2.63	1.13	1.50	2.63	
15	6.5	.75	4.88	6.50	11.38	4.88	6.50	11.38	
16	5.3	.65	3.45	5.30	8.75	3.45	4.60	8.05	— .70
17	.5	.65	.33	.50	.83	.33	.44	.77	— .06
18	4.9	.40	1.96	4.90	6.86	1.96	2.62	4.58	—2.28
19	5.1	.80	4.08	5.10	9.18	4.08	5.41	9.49	+ .31
20	.5	.65	.33	.50	.83	.33	.44	.77	— .06
21	2.5	.75	1.88	2.50	4.38	1.88	2.50	4.38	
22	.9	.75	.68	.90	1.58	.68	.91	1.59	+ .01
23	.2	.75	.15	.20	.35	.15	.20	.35	
24	3.2	.75	2.40	3.20	5.60	2.40	3.20	5.60	
25	.5	.65	.33	.50	.83	.33	.44	.77	— .06
26	6.0	.70	4.20	6.00	10.20	4.20	5.60	9.80	— .40
27	1.1	.75	.83	1.10	1.93	.83	1.12	1.95	+ .02
28	2.6	.75	1.95	2.60	4.55	1.95	2.61	4.56	+ .01
29	3.3	.85	2.81	3.30	6.11	2.81	3.76	6.57	+ .46
30	.2	.85	.17	.20	.37	.17	.23	.40	+ .03
31	.3	.85	.26	.30	.56	.26	.35	.61	+ .05
32	.2	.85	.17	.20	.37	.17	.23	.40	+ .03
33	.1	.85	.09	.10	.19	.09	.12	.21	+ .02
34	.2	.85	.17	.20	.37	.17	.23	.40	+ .03
35	.2	.85	.17	.20	.37	.17	.23	.40	+ .03
36	.3	.85	.26	.30	.56	.26	.35	.61	+ .05
	101.9		76.44	101.90	178.34	76.44	101.90	178.34	NO

MAKING Phosphor Bronze ALLOYS

By N. K. B. PATCH

FOUNDRIES follow a wide variety of practices in the production of phosphor bronze. Many make these from scrap or ingot. Others use raw materials of average impurity, and still others employ the purest of raw materials under the most careful and rigid laboratory control. All of which lead to the production of a large number of different grades or qualities in similar alloys.

Each foundryman believes he is producing the quality best suited to the particular purpose. A definite value rests in using intelligently the different types of raw materials available for the manufacture of these valuable alloys. No objection is raised to the use of the highest possible quality of scrap. The problem is to sort and recognize that *highest possible quality*. Few are able to do this with any absolute certainty. In fact it is an impossibility to differentiate between the different grades of phosphor bronzes by the simple process of looking at a piece and studying its color, its hardness when subjected to a file or some other easy test.

Chemical Analysis Is Necessary

It becomes absolutely necessary that the scrap must be subjected to the necessary tests, such as chemical analysis, etc. if the highest quality of product is to be made. The only economical way to do this is to melt up the scrap under good metallurgical conditions, sample the resulting material, analyze it chemically, test it physically and determine whether it needs additions to bring it up to the desired standard, or whether it is serviceable at all for the production of the particular grade of bronze.

Intelligent use of scrap requires equipment and experience peculiar to a specialized industry. Thus it is better, if scrap is to be the raw material, to use it in the form of ingots purchased from producers of high grade ingots of standard analysis. Such companies are equipped with proper mechanical equipment and experienced personnel, including chemists and metallurgists, to insure uniformity of quality that is essential to the production of a completely satisfactory casting. Obviously, if the bronze from which a casting is to be made varies, production of uniform casting is impossible.

If the raw materials are to be of new metals, an intelligent selection of these is desirable if the best product is to be made. Copper having even a small percentage of arsenic may give trouble in some of phosphor bronze alloys. In a lead free alloy it is important that the raw materials be lead free, since a small percentage of lead in the tin must necessarily develop a proportional lead content in the resulting casting, which may lead to rejections where rigid specifications must be met.

Maintain Accurate Phosphorus Control

In the production of the phosphor bronze, it also is important to maintain an accurate control of the phosphorus. In many instances it is intended that only just enough phosphorus be used to consume the oxygen in solution in the alloy and produce a completely deoxidized product without having any appreciable phosphorus left to influence the physical characteristics. In other phosphor bronzes a definite minimum percentage of phosphorus is part of the specification. Consequently, the proper amount of phosphorus must be added to develop the desired amount in the resulting alloy and to compensate for that used in deoxidizing the alloy.

Phosphorus in appreciable quantities has a definite hardening effect on bronzes. The copper phosphide crystal is definite and has characteristics that are found desirable for some particular conditions. Nickel, in varying proportions, increasingly is used in the manufacture of these phosphor bronze alloys for specific types of service. Nickel is soluble in copper in all proportions. To state it in another way, copper and nickel mix to form a solid solution in all proportions from 1 (*Please turn to page* 96)

A LITTLE KNOWLEDGE Is A Dangerous Thing

By JOHN HOWE HALL
Philadelphia

DURING the World War years converter operators suffered severely from a shortage of low sulphur content cupola coke. As a result, much of the converter product of that period was high in sulphur picked up from the coke in the cupola charge. In addition to the tendency of high sulphur to form hot tears in the castings, high sulphur steel suffers more than low sulphur metal from small aluminum additions.

Since converter and openhearth steel to greater or lesser extent also are subject to aluminum embrittlement, undoubtedly numerous heats of converter metal made during the war suffered from the low ductility disease. However, the introduction of the method of lowering sulphur by treating the converter charge with fused soda ash, either in the cupola, in the iron ladle, or both, largely had eliminated that source of difficulty in converter steel at the time of the specification discussion described in a preceding section. Actually no reason existed for condemning converter steel on that score.

Give a dog a bad name and hang him, is true in metallurgy as in other things. In the denunciation chorus of the converter, the sulphur problem was emphasized thoroughly. How completely this phase of converter practice has been licked is evident from Table IV in this section and Tables I, II and III in preceding sections. The sulphur content of converter steel of recent manufacture varies from 0.020 to 0.040 per cent, with most of the blows in the neighborhood of 0.03 per cent.

To operate a side blow converter, the metal of the charge must contain a considerable amount of carbon, to set up the *boil* in the latter part of the blow that permits of heating the steel throughout the deep bath. Silicon and some manganese necessarily are present, since the heat required to raise the temperature of the charge from that of melted cupola iron to that necessary to pour low carbon steel, is derived, not from any outside source, but from the combustion of the silicon, manganese and some iron, to silica, manganese oxide and iron oxide. The metal charged to the cupola consists of steel scrap and a greater or smaller amount of pig iron and ferrosilicon to provide the necessary content of silicon and manganese. The required carbon is obtained partly from the pig iron, partly by absorption from the coke. Of late years the pig iron to scrap ratio has been reduced radically, as more efficient cupolas have been developed. The silicon content to an increasing extent comes from ferrosilicon.

According to generally accepted theory, side blow operation is a step by step process, leading to the vigorous boil and final flame that conclude the process of conversion. As air is blown over the molten bath, silicon, manganese, carbon and iron are oxidized. Slag grows progressively richer and richer in iron oxide as the carbon, silicon and manganese are eliminated from the surface metal, leaving the iron unprotected and hence more free to oxidize. Eventually a point is reached where slag becomes very rich in iron oxide, with a maximum fluidity. As carbon diffuses from the metal below into the upper layers of the bath, a reaction sets in between carbon and the *FeO* of the slag, resulting in rapid evolution of *CO* and a consequent *boil*. That reaction generally subsides after a few minutes, during which the blast pressure is reduced, but it may in some cases be repeated one or more times. The last time a boil is established, it persists vigorously, with free evolution of *CO*, until the carbon of the entire bath is reduced to about 0.08 per cent, and the silicon and manganese to approximately the same amount. Burning of *CO* to CO_2 at the mouth of the converter, both at the time of a boil, and when the final stage is reached, produces the flame characteristic of the process. Disappearance of that flame when the last of the carbon is oxidized signals completion of conversion. End of the process is marked by rapid shortening of the flame, indicating that the carbon has been reduced to the desired point, and that the oxidation and heating-up stage is over.

Temperature of the metal is judged by the color and intensity of the final flame. If it is too low, additions of ferrosilicon are made to the metal to secure higher temperature. This is done by throwing or shoveling lumps of ferrosilicon into the mouth of the vessel. Too hot a (*Please turn to page* 86)

QUESTIONS AND ANSWERS

Deciding Factor in Selection Of Coke Is Composition

We are submitting two pieces of coke. The darker piece seems to give us the best satisfaction in a small cupola and in the brass furnace. Can you give me the analyses of the two samples or tell me how to order either one.

An experienced foundryman usually can gain a fair approximation of coke quality by the appearance of the fracture and by the weight. However, appearances sometimes are deceptive. The two most important items in coke for metallurgical purposes are the fixed carbon and the ash content. Maximum carbon insures maximum temperature in the metal, while minimum ash reduces the amount of slag. The following standard represents a good foundry coke: Volatile matter, not over 2.00 per cent; fixed carbon, not under 86.00 per cent; ash not over 12.00 per cent; sulphur not over 1.00 per cent. All the coke producers are prepared to quote the analysis of their product. Checkup analysis can be secured through any commercial laboratory.

Employment of Excess Blast Cuts Out Cupola Lining

Our 41-inch cupola shell lined to 32 inches with a single wall of arch brick is provided with continuous tuyere showing a total area of 124 square inches. A positive pressure blower delivers 2800 cubic feet of air per minute. The coke bed is 36 inches high. The charge is made up of 20 per cent of 2.75 per cent silicon pig iron and the remainder good machinery scrap. We place a 1200-pound charge on the bed, 1000 pounds on each of the remaining charges with 75 to 80 pounds of coke and 30 pounds of limestone on each charge. The cupola delivers approximately 3 tons per hour good hot iron, but the lining at the melting zone is completely burned away in melting a heat of 14,000 pounds.

Operation of your cupola is one of the most peculiar that ever has come to our attention. You are blowing 2800 cubic feet of air per minute into a 32-inch cupola and melting 3 tons per hour. That amount of air is sufficient for a 42-inch cupola melting 7 tons per hour. The coke splits are 75 to 80 pounds between 1000-pound charges of iron. That is a ratio of 1 pound of coke to 12.5 pounds of iron. With occasional exceptions, foundrymen find it necessary to use a ratio of 1 to 8. With an over supply of air and an under supply of coke we cannot understand how the cupola can deliver hot iron. Excessive burning of the lining probably is caused by a high blast kept on until the bottom is dropped. In line with ordinary cupola practice we suggest continuation of the present bed and coke charges, but a drop in the air supply to 1800 cubic feet per minute, a reduction of the iron charges to 700 pounds and of the limestone to 25 pounds. Shut off the blast when the cupola is almost empty, that is shortly before the last tap.

Supply Information on Various Phases of Manganese Steel

Can you give information on the correct pouring temperature for high manganese steel, that is from 10 to 15 per cent manganese, recommended type of ladle to avoid slag entering the mold, best composition of molding sand for this kind of steel, and why is a very thick crust of metal formed when pouring and why its pasty nature?. What are other important features in foundry practice for this special steel?

Manganese steel melts at 2588 degrees Fahr. according to the most reliable figures. Small castings require considerable superheat, and may be poured at temperatures up to 2800 or 2850 degrees Fahr. It should be remembered that the higher the pouring temperature, the coarser the crystal structure, and the lower the tensile strength of the metal. This is more true of manganese steel than of ordinary steels. Heavier castings should be poured at temperatures but little above the solidification point to avoid the coarse structure and also to prevent hot cracks and tears in the castings.

It is customary in many shops to start pouring heavier castings when the steel has formed a slight scum over its surface; in other words, when it has started to solidify. Of course, when that practice is

followed, it is necessary to get the metal out of the ladle rapidly, or there will be a big loss in ladle skull. Control of pouring temperature in a foundry making a wide line of manganese steel castings is a matter requiring considerable experience and judgment.

Bottom pour ladles generally are not used on manganese steel castings, due to difficulty of securing tight shut-offs. The steel is particularly severe on nozzles and stoppers, so that leaky stoppers are practically unavoidable when attempt is made to use bottom poured ladles. Opinions differ as to the advisability of using teapot ladles. When they are used, it often is found that the spouts plug up badly when the metal is poured close to its melting point.

Most foundries find it advisable to pour the smaller castings from the hot metal available from the first part of the full ladle, going to the heavier molds with the last part poured. That practice results in gumming up the spouts of teapot ladles, with resulting extra expense for repair. For that reason, many shops prefer the old fashioned lip-pour ladles, similar to those used for many years for pouring iron. The ladle lining should be magnesite. Sand or clay linings, or those of ganister not being satisfactory.

Molding sands used for manganese steel are similar to those used for ordinary steel, good green sand mixtures being satisfactory for the lighter castings, and dry sand for heavier work. Recent work has demonstrated that the Randupson process, using cement-bonded molds is eminently satisfactory for manganese steel.

There should not be a very thick crust of metal formed upon pouring manganese steel. If it is being handled too cold, of course, the top will freeze over and make it difficult to get the last of the steel out of the ladle. Incorrect composition of manganese steel made in the electric furnace sometimes results in a scum forming over the surface of the metal, even when it is hot, but this cannot be described as a very thick crust, nor is it exactly pasty. It is rather a dry appearing crust, thin, and due to too low a silicon content.

There is not a great deal in print about the manufacture of manganese steel. For a general description of the material, readers are referred to an article by John Howe Hall in the American Society for Metals *Handbook*, 1939 edition, page 567.

Melting and Cyaniding Pots Do Not Stand Up Long

Can you tell us what gray iron analyses are suitable for zinc melting pots and also for cyaniding pots? Analysis of our iron is substantially: Silicon, 2.43 per cent; manganese, 0.60 to 0.80 per cent; phosphorus and sulphur both below 0.10 per cent; carbon, 3.10 to 3.20 per cent and chromium, 0.80 per cent. Our present mixture is made up of 40 per cent bessemer pig with 2.73 per cent silicon; 30 per cent steel scrap; 15 per cent silvery mayari with 9.28 per cent silicon and 15 per cent return scrap. The zinc seems to eat away the iron and causes holes to appear quickly. The same kind of failure occurs with pots which we make for cyaniding.

It appears that your present mixture results in what is termed a soft iron, which does not possess the desired resistance to heat and corrosion. Therefore change the mixture so that a much harder iron is secured. That may be obtained by using a mixture composed of 50 per cent steel scrap, 20 per cent bessemer pig, 15 per cent silvery mayari and 15 per cent return scrap. The analysis of your iron shows about 0.80 per cent chromium which is considerably higher than might be expected, unless more chromium in the form of ferrochromium is added.

According to our calculations the mixture you are using now and the one we have suggested, will contain about 0.30 per cent chromium without considering the melting loss. We believe that by the further addition of say 0.50 per cent chromium and 1.50 per cent nickel or 0.50 per cent molybdenum, you can enhance further the heat and corrosion resistance of the castings.

Defects Are Caused by Steam Trapped in Casting Neck

We are forwarding the halves of two separate small castings in which a defective area appears slightly above the center. Cavities are not exactly alike and we shall appreciate your opinion on whether they are shrink holes or blow holes, or if one is a shrink hole and the other a blow hole. What remedy would you suggest? What iron analysis would you recommend for this casting to prevent this form of defect and yet retain good machinable quality? The castings are given a short gray iron anneal. The pattern equipment consists of six units on an aluminum matchplate. With the exception of the mound of sand on the inside, the entire mold is in the cope. Metal enters the mold through two small gates at the bottom edge of each bell.

From a molding standpoint you have adopted the easiest method, but from a theoretical standpoint the castings should be poured in the opposite position. Cavities in both castings are blow holes caused by steam developed in the mound of sand on the inside of the lower part of the mold. Some of the steam escapes through the drag, but a certain amount is trapped in the neck of the casting. In addition to forming blow holes, agitation causes the metal to freeze rapidly in the vicinity and thus interferes with normal shrinkage and contraction. Thus the cavity really is a combination shrinkage and blow hole. Fortunately, the remedy is quite simple.

By venting adequately the body of sand on the inside of the casting, all steam will pass through the drag and the metal will lie quietly in the mold. If the castings are made in limited quantities, the vent in each mold may be made with a ¾-inch diameter sprue cutter driven down to within ½-inch of the crown of the pattern. On a large production basis, six of the sprue cutters could be mounted on a suitable frame and employed as a unit.

Incidentally the skin on the side walls of the casting is rougher than necessary. A magnifying glass shows the surface impregnated with small sand grains. Since it is not practical to brush or shake blacking on vertical mold walls, we suggest the use of sea coal in the sand. From the appearance of the fractured surface of the casting we should say that the iron you are using is quite satisfactory.

Need Alloy Iron to Resist Rusting

Will you give us a mixture for nonrusting cast iron? We wish to make some name plates that will be exposed to the weather, and would like to have an alloy iron, rust proof if possible.

So far as we know, there is no alloy cast iron which is completely rust proof. Even the most highly alloyed cast iron, we understand, will develop a thin, but perceptible coating of rust when exposed for a time in the ordinary, moist atmosphere. However, the thin coating developed is tightly adherent and does not change after it is once developed. Possibly by polishing the raised portions of the name plate and then coating them with a clear, weather resistant lacquer, the plates would present a satisfactory appearance for a long time.

For your purpose, we believe that a composition containing about 14 per cent nickel, 7 per cent copper, and 2 per cent chromium will serve. While that material is highly corrosion and scale resistant, it will as we have pointed out previously, develop a thin coating of rust. It may be polished to a high luster, and we believe that a thin coating of a suitable lacquer will preserve the luster for a long time.

Wants Blue Color For Stove Tops

We are trying to improve our method of blueing or gun metalling stove tops. We know about the high temperature process, but we want to use a low temperature oven which we operate at 550 to 600 degrees Fahr. In using that oven we find that our tops are not uniformly colored when they come out. Some have the desired blue color and others are red. These castings, after buffing, remain brownish or reddish in color. Can you give us any suggestions?

We believe that your difficulty in obtaining a uniform blue color on your castings is due to the fact that the temperatures employed are not quite high enough. According to the usual color charts, heating at 490 degrees Fahr. produces a brown scale; 536 degrees develops a purple; 570 degrees produces a pale blue and 600 degrees results in a dark blue. Consequently it appears that to obtain a dark blue color consistently, the temperature never should go below 600 degrees Fahr., and it might be advisable to set the minimum at least 625 degrees. Also the castings should be left in the oven until all sections are at the same temperature. Usual allowance is 1 hour for each inch of thickness, based on the heaviest section which in your case with comparatively thin sections not over ¼-inch would mean 15 to 20 minutes.

Another method of securing a blue color would be to employ a molten salt bath which is composed of equal parts of sodium nitrate and potassium nitrate which contains one part of manganese dioxide to 50 parts of the combination nitrates. The molten bath is operated at 600 to 650 degrees Fahr. If you are interested in obtaining a black coloration, that may be secured by immersing the castings from 20 to 30 minutes in a bath composed of sodium hydroxide, 400 grams per liter, potassium nitrate, 10 grams per liter, and sodium nitrate, 10 grams per liter. In English measure that figures out to approximately 31/3 pounds of sodium hydroxide, 11/3 ounces of potassium nitrate, and 11/3 ounces of sodium nitrate per gallon of water. Operating temperature of the bath should be 250 degrees Fahr.

Cores May Be Used Inside or Outside

Can you define clearly the terms core and mold. It is somewhat confusing to find that a core may be used to form either the inside or the outside of a casting.

In strict accordance with the niceties of the language as set forth in the dictionary, a core is a body of sand inserted in a mold to form a cavity in a casting. However, custom and tradition over a long period in the foundry have sanctioned the use of the term *core* to mean any body of sand prepared separately and later used as a component part of a mold. This is irrespective of whether this body of sand forms in part or in whole, the inside or the outside of the casting.

The custom of course is based on the fact that cores are baked or dried in an oven. Consequently any body of unenclosed sand baked in an oven is a core. This custom in the foundry of referring to a baked body of sand as a core, is so well known and so widely observed, that we do not think any writer ever considered it necessary to comment on the fact that the core may be placed either on the inside or outside.

Following the same line of reasoning a foundryman considers a mold any receptable into which metal is poured. It does not matter if this receptacle is a metal form, a cavity formed by a pattern in the sand, or a number of dried blocks of sand assembled in any desired formation. Every trade and profession has its own nomenclature and so long as the terms cause no confusion among those who practice the trade or profession, it should not matter what interpretation others put upon them.

Desires Composition For Worm Gear

We will appreciate greatly information on the most suitable analysis and pouring temperature of phosphor bronze to be used for a gear blank 16 inches in diameter, 11-inch bore, 3½ inches thick, weighing 96 pounds. Casting to be made in green sand, machined all over, and teeth hobbed in.

Worm gear bronzes which are sand-cast do not have the same characteristics as chill-cast bronzes, and since you are to produce the former, the best alloy will be one containing sufficient tin to provide an ample amount of bearing or wear-resistant crystals known as delta or secondary constituent. Such bronzes contain 88 per cent copper, 10 per cent tin, and 2 per cent zinc; 88½ per cent copper, 11 per cent tin, and ½ per cent lead; 86½ per cent copper, 10½ per cent tin, 1½ per cent lead, and 1½ per cent zinc; 89 per cent copper, and 11 per cent tin, and 86½ per cent copper, 11 per cent tin, ½ per cent lead, and 2 per cent zinc.

Type of steel used for the worm will have an important bearing in the life of the alloy. If a heat treated alloy steel worm, polished and ground, is to be used then the hardest of the bronzes previously mentioned, and containing no lead, will give maximum satisfaction. If the worm is not hardened and ground or made of machinery steel without heat treatment, the best results will be secured from a gear bronze containing about 1½ per cent lead, and which will conform to the surface irregularities encountered.

Pouring range of the alloys mentioned is from 1920 to 2020 degrees Fahr., and they must be melted carefully to prevent absorption of furnace gases. Heavy risers should be employed to insure adequate feeding of the blanks otherwise the roots of the teeth may show evidences of porosity.

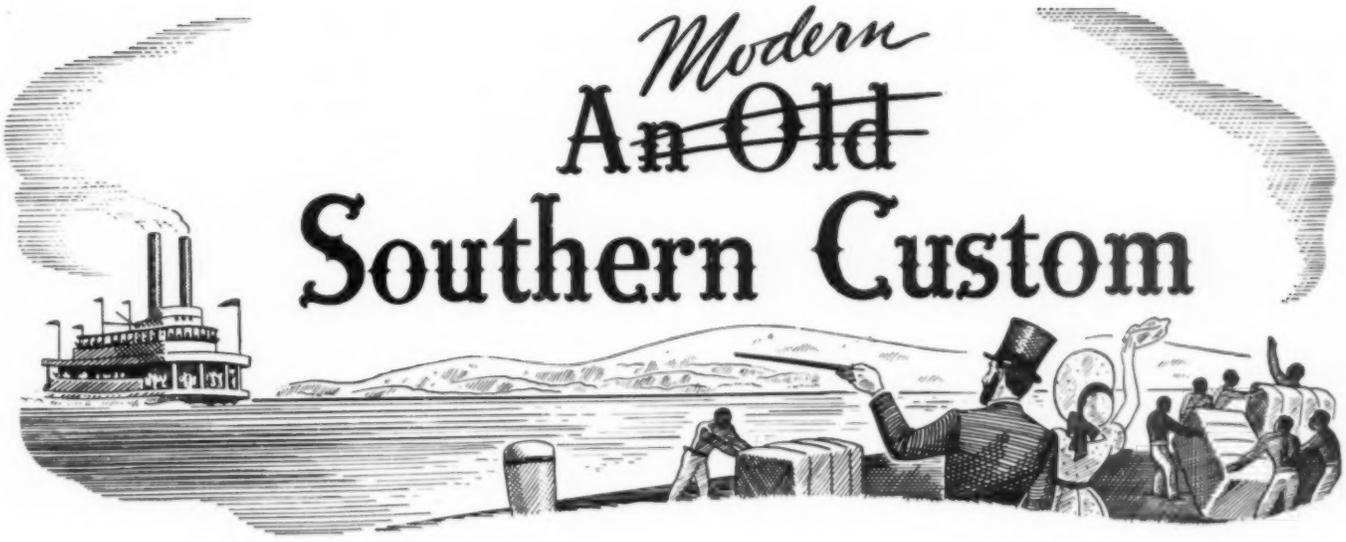
Spongy Aluminum in Large Casting

We are having trouble with an aluminum casting approximately 4 inches square and 8 to 10 feet in length. The casting is finished on all four sides. We skin dry the mold, melt the metal in graphite crucibles and pour as cold as possible. A spongy area near the gates penetrates deeply into the casting.

The spongy areas in the vicinity of the gates are caused by shrinkage. The highest temperature metal is in the gate and this metal flows into the casting when cooling and shrinkage begins. In a few seconds the metal freezes in the small gate

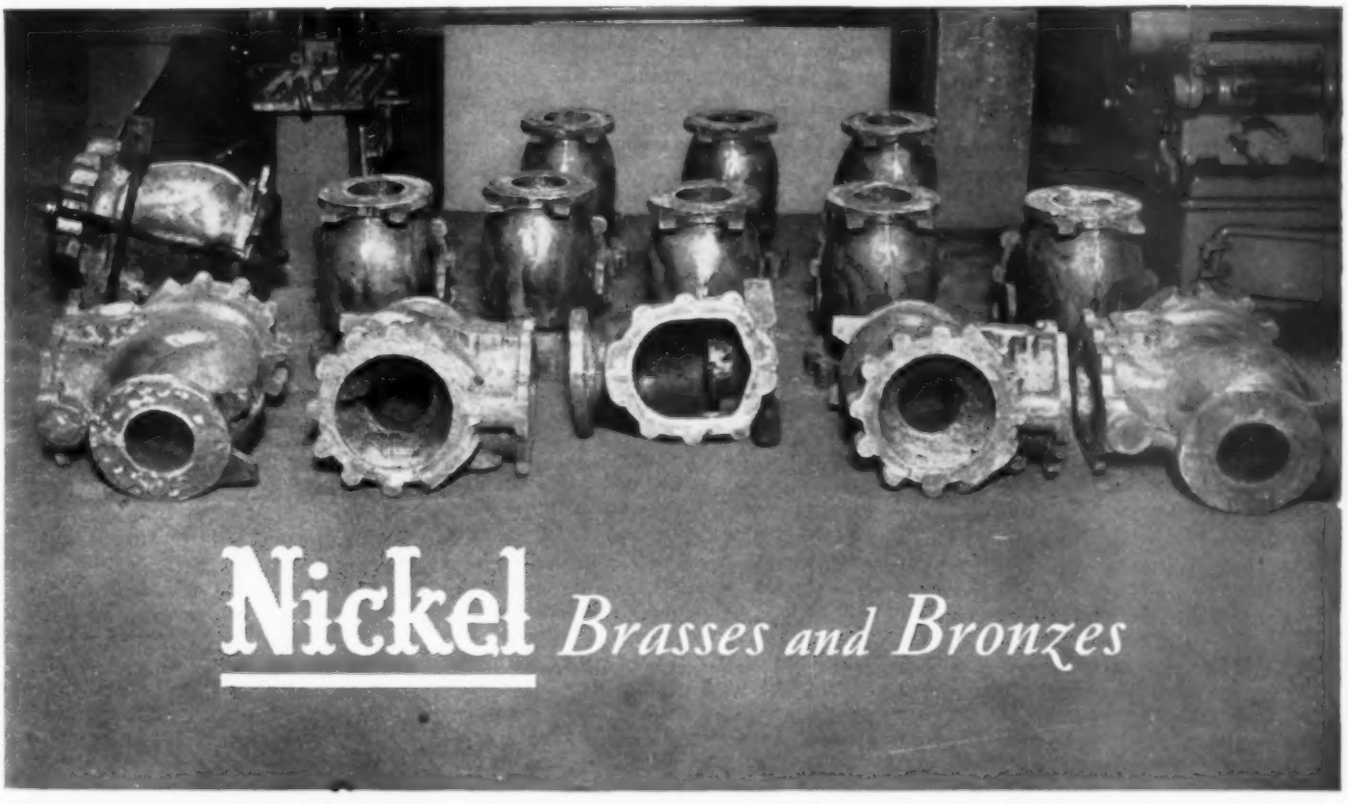
(*Concluded on page 40*)

Modern ~~An Old~~ Southern Custom



Nowadays progressive foundrymen rely upon Nickel to minimize shrinkage porosity and refine the grain of castings which must be pressure tight. Down in New Orleans, the F. H. Koretke Brass and Mfg. Co., cast these 6" water meter valves to withstand 225 lbs. pressure per square inch. Koretke uses an 88-10-2 "G" bronze mixture, modified by 1½% Nickel. • By replacing 3½% tin in this bronze composition with an equal amount of Nickel, similar castings will withstand more than 3,000 lbs. pressure per square inch. • The practical observation of many foundrymen has firmly established the fact that Nickel improves metal fluidity which aids in filling all parts of the mold and reduces rejections. By promoting a dense close-grained structure, Nickel assures pressure tightness of brass and bronze castings. • Improved pressure-tightness is but one of many money saving advantages Nickel offers you men who cast and use brass and bronze. Please write for more detailed information about money-saving applications of Nickel.

Water meter valve bodies weighing 27.5 lbs. each, cast by the F. H. Koretke Brass & Mfg. Co., New Orleans. Their "G" bronze composition was alloyed with 1½% Nickel.



THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

(*Concluded from page* 38)

The metal in the casting continues to shrink, and since the gate no longer supplies fresh metal, the area in the vicinity either shows a distinct opening, or a spongy structure. Obviously the remedy is to provide a type of gate in which the metal will remain liquid until the casting ceases to draw from it. In this particular case we suggest four 4-inch diameter risers 8 inches high. One a foot from each end of the casting, and the other two spaced about 3 feet apart. Instead of using the ordinary type sprue and gate, pour the metal from two crucibles simultaneously into the two end risers.

Incidentally the 10-foot casting will require all the metal in two No. 80 pots without the risers. Metal from a third pot will be required to fill them. If you have many of the castings to make, the best method would be to construct an iron mold, split diagonally like a billet mold, and pour the castings in a vertical position. To ease the fall of the metal, the mold could be held in an inclined position until partly filled and then turned up on end. The casting would be 8 or 10 inches over the desired length to take care of dross or piping. The extra head later is cut off.

Desires Alloy Iron For Hardening

We operate a foundry in Greece and would like to know if you can tell us what are the standard analyses of alloy cast irons used in the United States for heat treatment, and instruction on how those alloys should be tempered. If standard analyses are not established, what in your opinion would be the best analysis of an alloy cast iron suitable for hardening by oil quenching and tempering.

So far as we know there is no standard composition alloy cast iron which will be suitable for all applications. In other words a composition suitable for heavy sections hardly would be applicable for thin section castings. Since you do not state what the castings are, the only thing we can do is suggest a few applications, and from those you might be able to make adjustments to fit your particular needs.

Diesel engine cylinder sleeves ranging from $\frac{3}{8}$ to $\frac{7}{8}$-inch thick are made from an iron containing 2.00 to 2.20 per cent silicon; 3.00 to 3.20 per cent total carbon; 0.20 per cent maximum phosphorus; 0.50 to 0.70 per cent manganese; 0.20 to 0.40 per cent nickel; 0.40 to 0.60 per cent molybdenum; and 0.20 to 0.40 per cent chromium. Those castings are normalized for one hour at 1550 degrees Fahr.; oil quenched from 1575 degrees Fahr., and drawn at 450 degrees Fahr.

Forming and hot bending dies ranging from 2 to 15 inches in thickness are made from an iron containing 2.00 to 2.40 per cent silicon; 2.60 to 2.90 per cent total carbon; 0.20 per cent maximum phosphorus; 0.55 to 0.70 per cent manganese; 1.40 to 1.70 per cent nickel; 0.40 to 0.60 per cent molybdenum; and 0.35 to 0.50 per cent chromium. Those castings are oil quenched from 1550 degrees Fahr. and drawn at 350 to 400 degrees Fahr.

Heavy duty sheet metal drawing dies ranging from 2 to 5 inches in thickness are made from an iron containing 1.35 per cent silicon; 2.90 per cent total carbon; 0.07 per cent phosphorus; 0.80 per cent manganese; 1.75 per cent nickel, and 0.35 per cent chromium. The castings are oil quenched from 1575 degrees Fahr. and drawn at 950 degrees Fahr.

Crucibles Are Used To Melt Steel

In a new crucible type furnace recently constructed in our plant we can get high temperatures. Do you think we could melt steel for small castings in this furnace? What temperature is required? What material is used to slag the metal? We shall use a No. 80 crucible.

Crucible melting is the oldest of the four steel melting methods, crucible, bessemer, open hearth and electric furnace. However, for a variety of reasons not necessary to discuss at the moment it has almost completely disappeared, at least so far as the American foundry industry is concerned. Considering all the factors, including the necessary experimental period, our advice would be to buy your occasional steel castings from a regular steel foundry, instead of attempting to make them.

Steel foundry technique is quite different from that prevailing in gray iron or brass foundries. You would have to set up a special department under the supervision of a skilled steel foundryman. Molding and core sands used in iron or brass foundries are not suitable for use in a steel foundry. While your furnace might attain a temperature of approximately 3100 degrees Fahr., sufficient to melt the steel, that is only one factor in the process. A working knowledge of chemistry and metallurgy is essential on the part of the man in charge of operation. He also must have practical experience to guide him in the manipulation of the furnace and pots during the melting period.

Bronze Valve Leaks Under Pressure

We are forwarding a small valve body casting. This casting is tested at 100 pounds pressure and we find that a considerable number leak around the neck. The casting is gated at one of the hexagon ends and is cast from the following mixture: Copper 75 per cent, tin 2 per cent, red brass scrap 5 per cent, zinc 17 per cent.

After breaking the valve casting apart we found several sizable slag inclusions and these of course furnished the porous passage for the leaks. We also discovered a long cold shut in the diaphragm. The combination would seem to indicate first that the pot was not skimmed properly and second that the metal was too cold. In addition to producing cold shuts in the casting, cold metal is more viscous than hot metal and therefore, clings tenaciously to stray particles of slag.

Whereas these particles will float to the top of *hot* metal and can be removed, they remain in *cold* metal and are carried into the mold where they are deposited in the wall of the casting. In gating this type of casting preferably the runner and gates should be in the cope and the sprue should extend at least 4 inches above the top of the castings to impart a slight pressure and feed the castings properly. Apparently your molding and coremaking practice are quite satisfactory since there is no evidence that the metal does not lie quietly in the mold. In the present instance the only precautions necessary are to skim the metal and pour it at a higher temperature.

Drain Casting Must Resist Pressure

We make an aluminum oil drain connection that has to stand oil pressure of 50 pounds per square inch. However, when the castings are tested for that pressure, they all leak. We have tried to overcome the trouble without success. Can you give us information on aluminum alloy that can be used for the casting and which will not leak?

A pressure of 50 pounds per square inch is not very high, and no difficulty should be encountered. A suitable alloy for pressure work is the 5 per cent silicon aluminum alloy. We suggest that you make a careful study of your melting conditions and see that your alloys are not melted at too high a temperature or are permitted to remain in the furnace any longer than is absolutely necessary. Molten aluminum is likely to absorb gases.

GREY-IRON FOUNDRY SAVES 13 TO 22% ON CORE BINDER COSTS

Truline Binder has what it takes to make money for you. Here are ways in which one of our customers, a large grey-iron foundry, is saving money on cores.

16% Saved on Core Binders

In one mix, Truline Binder, replacing part of a more expensive binder, reduced binder costs 16%. Results are every bit as good.

13% Saved on Another Mix

In a rather "heavy" mix, two volumes of Truline Binder are replacing one volume of a higher-cost binder. With only partial replacement by low-cost Truline Binder, 13% of the total binder cost is saved. Casting results are identical.

22% Saved on This Mix

In a similar but lighter mix, Truline saves the foundry 22% by partially replacing higher-cost binder.

★ ★ ★ ★ ★

Truline saves for other foundries by cutting baking time, permitting the use of up to 70% black sand, and giving exact reproduction of core properties regardless of weather.

Investigate the savings that Truline Binder can make in your plant. Mail the coupon today — for more specific information, and a sample for testing purposes.

HOW TRULINE BINDER SAVES YOU MONEY

- Low initial cost.
- Pulverized to uniform fineness.
- Does not absorb moisture.
- Makes strong, permeable cores that will not sag.
- Cores collapse as metal shrinks.
- Burns out completely — reduces cleaning costs.
- Helps to eliminate cracks, especially in high-shrinkage castings.
- Permits easily controlled reproduction of core properties.

TRULINE BINDER CAN BE USED WHEREVER METALS ARE CAST

Reg. U. S. Pat. Off. by Hercules Powder Company.

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MEN of INDUSTRY

P. J. POTTER, vice president in charge of engineering, production and sales, Pangborn Corp., Hagerstown, Md., was elected president of the Foundry Equipment Manufacturers' association at the recent annual meeting. Mr. Potter, who was born in England, came to this country at the age of 10. He received his early education in Detroit, and immediately thereafter began his lifelong interest in foundries. Early training was received at the Michigan Steel Castings Co., with whom he remained until 1915. In February of that year, he was given the opportunity to represent the Pangborn Corp. in the Detroit territory. In 1916 that territory was enlarged to include all of the Central and Western states. In the Fall of 1921, Mr. Potter was appointed works manager at Hagerstown. On Jan. 1, 1932, he was appointed sales director of the organization, and, finally, July 1, 1935, he advanced to his present position.

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WILLIAM D. DUNN again has become associated with the Frazer & Jones Co., Syracuse, N. Y. Mr. Dunn is a graduate of the School of Applied Science, Syracuse university, and for 15 years was foundry superintendent of the Frazer & Jones Co. In 1932 he was appointed superintendent of the Acme Steel & Malleable Iron Works, Buffalo, and 4 years later became associated with the Chicago Railway Equipment Co., Chicago, as superintendent of that company's Marion Malleable Iron Works plant, Marion, Ind.

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GLEN J. WALKER has been made foundry superintendent, Superior Foundry Co., Cleveland. Mr. Walker received his early training in his father's foundry, the Tawas Iron Works, Tawas, Mich., which was established by his grandfather in 1867, and was one of the pioneer foundries in that section of the country. After leaving Tawas, Mr. Walker was chief inspector, Continental Motors Co. for 7 years. He then became general superintendent, Werra Aluminum Foundry, Waukesha, Wis., and from there became vice president and general superintendent of the Indianapolis Casting Co., Indianapolis. Before taking his present position, Mr. Walker was general manager, Michigan Valve & Foundry division, Timken-Detroit Axle Co., Detroit.

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CLEAVELAND F. COLBURN was recently appointed metallurgist for the Sterling Foundry Co., Wellington, O., machine tool and alloy castings manufacturers. Mr. Colburn was born in Fitchburg, Mass., and received his early education in the Fitchburg public schools and at Cushing academy in Ashburnham, Mass. His technical training was obtained at Rutgers university, New Brunswick, N. J., where he received his bachelor of science degree in 1937. Upon graduation he joined the laboratory staff of the Crompton & Knowles Loom Works, Worcester, Mass., where he specialized in the study, development, and production of improved grades of high-test and regular gray cast irons, as well as control of melting technique.

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DR. FRANCIS C. FRARY, research laboratories, Aluminum Co. of America, Pittsburgh, has been awarded the Acheson medal and $1000 prize for distinguished con-

(*Continued on page* 44)

William D. Dunn

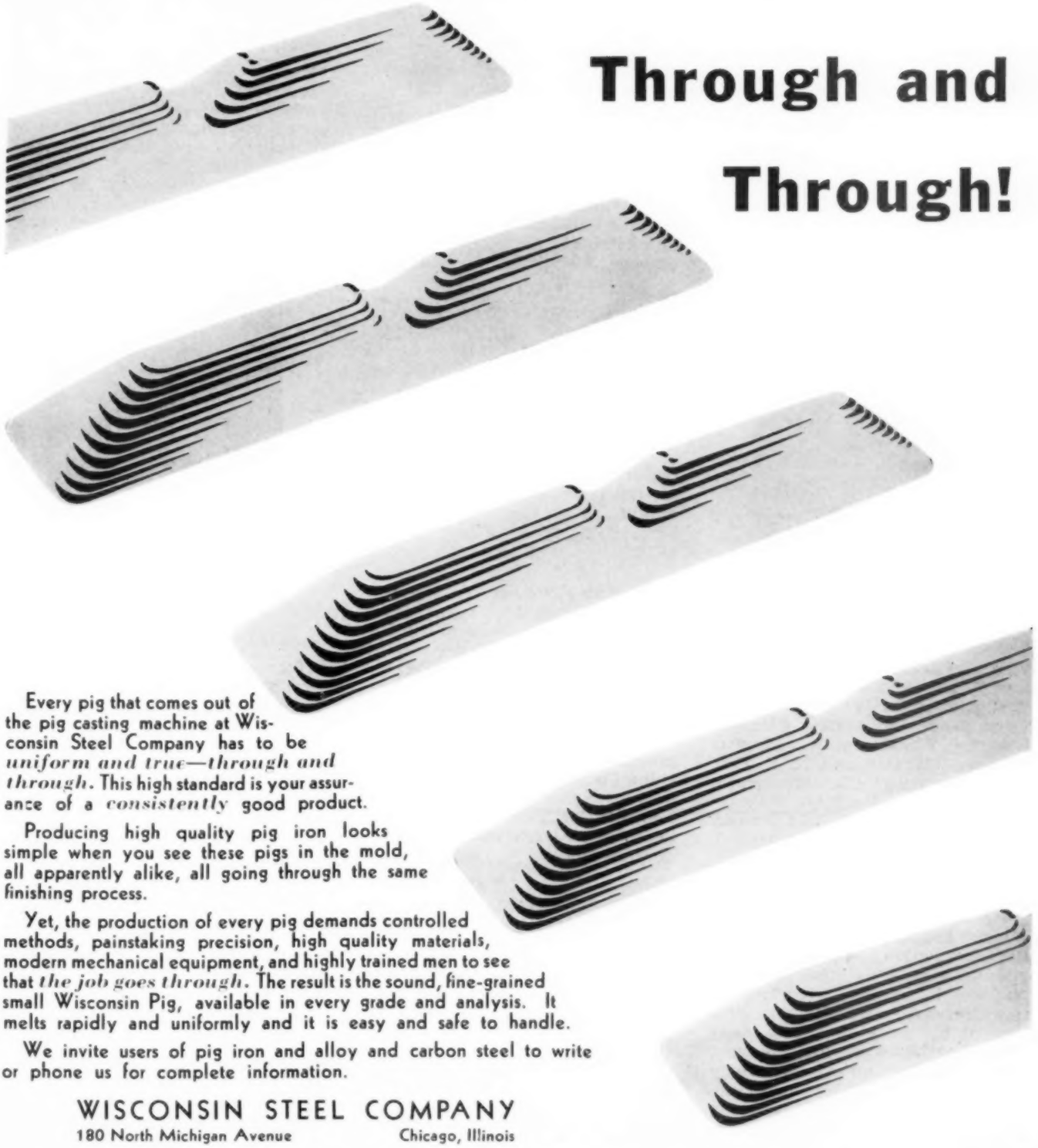
P. J. Potter

Cleaveland F. Colburn

Glen J. Walker

UNIFORM and TRUE—

Through and Through!



Every pig that comes out of the pig casting machine at Wisconsin Steel Company has to be *uniform and true—through and through*. This high standard is your assurance of a *consistently* good product.

Producing high quality pig iron looks simple when you see these pigs in the mold, all apparently alike, all going through the same finishing process.

Yet, the production of every pig demands controlled methods, painstaking precision, high quality materials, modern mechanical equipment, and highly trained men to see that *the job goes through*. The result is the sound, fine-grained small Wisconsin Pig, available in every grade and analysis. It melts rapidly and uniformly and it is easy and safe to handle.

We invite users of pig iron and alloy and carbon steel to write or phone us for complete information.

WISCONSIN STEEL COMPANY
180 North Michigan Avenue Chicago, Illinois

WISCONSIN PIG IRON

(*Concluded from page* 42)
tributions to electrometallurgy. Highest award for scientific achievement bestowed by Electrochemical society, the Acheson medal was presented Dr. Frary in recognition of aluminum alloys development.

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CHARLES MCDONOUGH, advertising manager, Combustion Engineering Co., New York, recently was elected president, National Industrial Advertisers association at its seventeenth annual conference held in New York Sept. 20 to 22.

Charles McDonough

Vice presidents elected are: RICHARD P. DODDS, Truscon Steel Co., Youngstown, O.; WILLIAM D. MURPHY, Sloan Valve Co., Chicago; HERBERT V. MERCREADY, Magnus Chemical Co., Garwood, N. J.; E. J. GOSS, Koehring Co., Milwaukee; TERRY MITCHELL, Frick Co., Waynesboro, Pa.; and H. S. VAN SCOYOC, Canada Cement Co. Ltd., Montreal, Que., Canada. RALPH LOUIS TOWNE, Surface Combustion Corp., Toledo, O., was elected secretary-treasurer.

Mr. McDonough during the past 3 years has been vice president of the association, supervising national as well as local publicity and was in charge of the employment service started 2 years ago. One of his more important association activities during the past 3 years has been an extensive study of public relations problems of industry. Mr. McDonough also is a past president of the Technical Publicity association, New York Chapter of N.I.A.A., and is vice president of the Combustion Publishing Co., New York, a subsidiary of the Combustion Engineering Co.

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GEORGE O. O'HARA recently was appointed sales manager, electrode division, Great Lakes Carbon Corp., Niagara Falls, N. Y. Mr. O'Hara was born and educated in Australia and he came to the United States in 1922. In Australia he was connected with the Broken Hill Pty. Co., Newcastle, N. S. W. in the laboratory and open hearth department, and with the Commonwealth Steel Products Co., Newcastle, as electric furnace melter. Between 1922 and 1930 he was connected successively with the International Nickel Co., Huntington, W. Va., Standard Steel Works Co., Burnham, Pa., Oil Well Supply Co., Oil City, Pa., in an operating capacity on electric and open hearth furnaces. Since 1930 he has been with the Republic Carbon Co., Niagara Falls, National Carbon Co., Cleveland, and Detroit Electric Furnace Co., Detroit, as sales engineer.

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J. G. GAMMEL has been appointed assistant advertising manager of the Osborn Mfg. Co., Cleveland. Mr. Gammel formerly was connected with several advertising agencies in New York.

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FRANK C. RICKS, power and construction department, Ford Motor Co., recently assigned to special duties with Ford interests in France, has returned to Dearborn, Mich.

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CHARLES F. COLBERT JR., formerly vice president, has been elected president, director, and member of the executive committee, of the Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

• • •

R. B. MOIR, formerly chief engineer, W. A. Jones Foundry & Machine Co., Chicago, has become associated with Foote Bros. Gear & Machine Corp., Chicago, as director of sales research and engineering development.

• • •

EDWARD H. PLATZ JR., since 1920 associated with sale of stainless and corrosion resistant alloy steels, has resigned from Faitoute Iron & Steel Co., Newark, N. J., to join the alloy steel sales department, Lebanon Steel Foundry, Lebanon, Pa.

• • •

J. H. CRAWLEY, formerly foundry superintendent, Pontiac Motor division General Motors Corp., Pontiac, Mich., is now assistant foundry superintendent McKinnon Industries Ltd., St. Catherine, Ont., an affiliate of General Motors of Canada.

• • •

JAMES DIXON has been appointed acting general manager, Ridgway plant of Elliott Co., Jeannette, Pa. Mr. Dixon formerly was assistant to general manager and succeeds R. H. GAITHER who resigned as vice president of the Elliott Co. and general manager of the Ridgway plant. The company manufactures power and industrial process machinery.

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STANLEY A. KNISELY, since 1934 advertising manager, Republic Steel Corp., Cleveland, has resigned to become executive vice president, Associated Business Papers, New York. Mr. Knisely is immediate past president, National Industrial Advertisers' association and vice president, Exhibitors Advisory Council Inc. Beginning as a reporter for the Canton, O., *Daily News*, he rose to managing editor

Stanley A. Knisely

before going to Cleveland as telegraph editor of the *Plain Dealer*. Leaving newspaper work in 1921, he became assistant secretary, National Paving Brick Manufacturing association and later director of advertising and research, National Association of Flat Rolled Steel Manufacturers. THE FOUNDRY is a member of Associated Business Papers.

• • •

CARL HARMON, formerly metallurgist and foundry superintendent of the Chevrolet Gray Iron Foundry, Saginaw, Mich., has organized and is general manager of the Saginaw Metal Products Co.

• • •

FRANK W. WABISZEWSKI, secretary, Maynard Electric Steel Casting Co., Milwaukee, has been appointed by Gov. J. P. Heil to a 6-year term as a member of the part-time advisory board which will supervise policies of the new state welfare department.

• • •

RICHARD W. YERKES recently resigned his position as secretary-treasurer of the Link-Belt Co., Chicago. HARRY E KELLOGG, closely associated with Mr. Yerkes for the past 18 years succeeds him as treasurer, and F. V. MACARTHUR, formerly assistant secretary, has been elected secretary.

SOLVING THE HARD ONES

Many a design problem that used to be troublesome is being worked out these days by the use of modern materials. Take logging trailer brake drums, for example.

Holding back 50 ton loads on long, steep grades and running high temperatures is all in their day's work. But, by making his drums of Chromium-Molybdenum (0.35-0.45% Cr.; 0.35-0.45% Mo.) iron, one of the leading manufacturers has more than met the severe operating conditions.

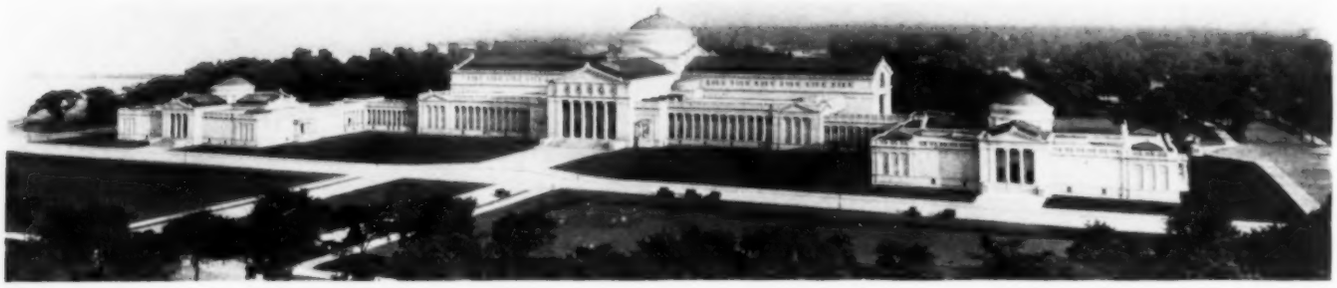
The iron is strong and tough, with good resistance to abrasion. Furthermore, it retains these qualities after repeated heating to around 900 degrees F. followed by rapid cooling. In addition the Molybdenum content reduces the tendency to distortion due to heating — thus reducing the pounding action that leads to premature failure.

Perhaps a re-check of your own materials specifications is in order. Our technical booklet, "Molybdenum in Iron" will prove helpful. It is free on request to production executives and engineers.

PRODUCERS OF MOLYBDENUM BRIQUETTES, FERRO-MOLYBDENUM, AND CALCIUM MOLYBDATE

Climax Mo-lyb-den-um Company
500 Fifth Avenue · New York City

MOLY



A foundry working exhibit will be dedicated at the Museum of Science and Industry during the Chicago Regional conference, Nov. 9 to 11. Illustration courtesy National Engineering Co., Chicago

CHICAGO REGIONAL

TO DEDICATE

FOUNDRY EXHIBIT

SECOND annual regional conference of the Chicago Chapter of the A. F. A., to be held in cooperation with the Museum of Science and Industry, Chicago, Nov. 9, 10 and 11, promises to be one of the largest affairs of its kind ever held. The conference will provide the formal opening of the extensive working foundry exhibit in the museum. This exhibit, which will be one of the few continual working exhibits on display at the museum, has been developed through the cooperation of a committee of the Chicago chapter. C. E. Westover, chapter chairman and also chairman of the Chicago chapter museum committee will present the exhibit to the museum at the Thursday night general assembly meeting. Dr. Philip Fox, museum director and world wide authority on physics and astronomy, will accept the gift on behalf of the museum.

Two evening meetings are planned. One Thursday evening following informal social dinners by each foundry group. Dr. H. W. Gillette, Battelle Memorial institute, Columbus, O., will give the principal address on, "Cupola Possibilities and Limitations for Making High Strength Irons." The annual conference dinner will be held at the Palmer house Friday evening, Nov. 10. Henry S. Washburn, president, Plainville Castings Co., Plainville, Conn., and president of the A. F. A., will welcome the visiting foundrymen and will introduce Col. Frank Knox, publisher, *Chicago Daily News*, and candidate for vice president of the United States in 1936. Colonel Knox will discuss "The International Situation."

As an added attraction to the program, Saturday morning will be given over to a special student meeting with Fred Melmoth, vice president, Detroit Steel Castings Co., Detroit, as the speaker. Visitors may attend the football game between Northwestern and Purdue at Evanston on Saturday afternoon following the close of the conference.

The tentative program of the conference is as follows:

Thursday, Nov. 9

9:00 a.m. Registration

10:00 a.m. *Gray Iron*—Chairman, Harold W. Johnson, Greenlee Foundry Co., Chicago. "Casting Defects as Related to Sand Conditions," by Harry W. Dietert Co., Detroit.

Malleable Iron—Chairman, L. F. Hartwig, Chicago Malleable Iron Co. "Duplexing and Its Various Ramifications," by F. C. Scheiber and C. C. Lawson, Wagner Malleable Iron Co., Decatur, Ill.

Steel—Chairman, H. E. Orr, Burnside Steel Foundry Co., Chicago. "Nondestructive Testing," by C. W. Briggs, Steel Founders' Society of America, Cleveland.

Nonferrous — "Discussion of Aluminum Alloys," by H. J. Rowe, Aluminum Co. of America, Cleveland.

12:00 Luncheon

2:00 p.m. *Gray Iron*—Chairman, Garnett P. Phillips, International Harvester Co., Chicago. "Modern Gray Iron Melting Practice," by Carl H. Morken, Carondelet Foundry Co., St. Louis.

Malleable Iron — Chairman, G. B. Stantial, Illinois Malleable Iron Co., Chicago. "Modern Annealing Methods and Metallurgy," by John Jans, Holcroft & Co., Detroit.

Steel—Inspection of Foundry Exhibit and Museum

Nonferrous — "Discussion of Nickel Silver Alloys," by D. M. Curry, International Nickel Co., Detroit.

4:00 p.m. Motion Pictures

6:30 p.m. Special Dinner of Each Group

8:00 p.m. General Assembly — Speaker, Dr. H. W. Gillett, Battelle Memorial institute, Columbus, O.

Friday, Nov. 10

10:00 a.m. *Gray Iron* — Inspection of Foundry Exhibit and Museum

Malleable Iron—Shop Practice Meeting, Malleable Founders' society Speaker, Enrique Touceda, Malleable Founders' society, Albany, N. Y. Subject, "Finishing of Malleable Castings." Chairman, J. H. Lansing, Malleable Founders' society, Cleveland.

Steel—Chairman, H. Forsberg, Continental Roll & Steel Foundry Co., East Chicago, Ind. "Cracking and Hot Tear Formation in Steel Castings and the Use of Oil as a Deoxidizer," by H. H. Blosjo, Minneapolis Electric Steel Casting Co., Minneapolis.

Nonferrous—Inspection of Foundry Exhibit and Museum

12:00 Luncheon

2:00 p.m. *Gray Iron*—Chairman, L. F. Lottier, Peoples Gas Light & Coke Co., Chicago. "Role of the Common Alloys in Gray Iron Castings," by A. DiGuilio, University of Detroit, Detroit.

Malleable Iron—Inspection of Foundry Exhibit and Museum.

Steel—Chairman, B. J. Aamodt, National Malleable & Steel Casting Co., Chicago. "Deoxidizers and Their Effect on Ductility and Cracking," by Walter Crafts, Electro Metallurgical Co., New York.

Nonferrous — "Discussion of Brass and Bronze Alloys," by C. V. Nass, Fairbanks Morse & Co., Beloit, Wis.

3:00 p.m. *Gray Iron*—Chairman L. F. Lottier, Peoples Gas Light & Coke Co. "The Uses of Phosphorus in Present Day Cast Iron," by Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.

Malleable Iron — Continuation of 10:00 a.m. Shop Practice Meeting.

4:00 p.m. Motion Pictures

7:00 p.m. Conference Dinner at Palmer House. Address by Col. Frank Knox, publisher, *Chicago Daily News*.

Saturday, Nov. 11

10:00 a.m. Student Conference—Speaker, F. A. Melmoth, Detroit Steel Casting Co., Detroit. Subject, "Place of Castings in Industry." Motion Picture, "Steel—Man's Servant."

Afternoon Football game—Northwestern vs. Purdue, Dyche stadium, Evanston, Ill.

ADVERTISING PAGES OMITTED

FOUNDRY DEVELOPMENTS AT SHORT RANGE

STEAMING or fogging on the inside of lens on safety goggles can be overcome by use of ordinary yellow laundry soap according to one safety supervisor. Just cut off a thin sliver of soap and rub it lightly over the inside of the lens. Then polish until the lens is clean.

* * *

Superheating magnesium alloys to 1550 to 1650 degrees Fahr. previous to pouring is claimed to be essential if the highest physical properties and refinement of grain structure is desired. The actual pouring temperature of course, is considerably lower.

* * *

A recently developed process for obtaining a lubricated surface on aluminum alloys used for pistons, bearings, etc. to reduce or eliminate wear, is described in a recent patent. The surface first is given an oxide coating by an electrolytic process, then it is dipped in an aqueous dispersion of deflocculated graphite, and dried. A more permanent coating is said to be obtained by addition of sodium silicate to the graphite suspension. Preferred graphite solution is made up of 1 part by weight of sodium silicate solution containing 25 per cent sodium silicate of the ratio 3.25:1, and 2 parts by weight of concentrated aquadag diluted with 3½ volumes of water.

* * *

AN IRON giving excellent service where resistance to heat and wear is required can be made by addition of a small amount of chromium and silicon to a medium strength iron. Cast iron chain stoker bars and fireboxes containing 1 per cent chromium and 2.50 per cent silicon are in commercial use, and are said to be giving excellent service.

* * *

Addition of chromium, titanium and magnesium to an aluminum-zinc alloy is claimed to give high physical properties according to a recent patent. The composition is given as 8 per cent zinc, 0.5 per cent chromium, 0.15 per cent titanium, 0.8 per cent magnesium, less than 0.8 per cent iron, less than 0.3 per cent silicon, copper and manganese, and remainder aluminum. No heat treatment is required and after 4 days aging at room temperature the alloy shows a tensile strength over 33,000 pounds per square inch, a yield point over 25,000 pounds per square inch, and an elongation of 3.8 per cent in 2 inches.

* * *

Addition of 0.1 per cent columbium to aluminum alloys is claimed to result in an extremely fine grain structure, even though the alloy be heated to a temperature of 1650 degrees Fahr. and held for 4 hours at that temperature. To give some indication of the effects of columbium additions an alloy containing 2.5 per cent copper, 1.5 per cent nickel, 0.8 per cent magnesium, 1.2 per cent silicon, and 1.2 per cent iron was poured at 1470 degrees Fahr. into a dry sand mold to insure slow cooling and tendency to coarse grain size. Without 0.1 per cent columbium the grain size varied from 2.5 to 5 millimeters in diameter, while with that amount of columbium the grain size was reduced to 0.2 to 1 millimeter.

* * *

According to leading members of the Illuminating Engineering society, the following standard illuminations are recommended for foundries: Charging floor, tumbling, cleaning, pouring, and shaking out —5 footcandles; rough molding and core making—10 footcandles, and fine molding and core making—20 footcandles.

* * *

In protecting nonferrous metals and alloys during melting from direct contact of the flame or products of combustion, it is preferable to employ an inert slag such as glass rather than charcoal. While charcoal prevents oxidation losses, it may have a harmful effect either on account of the increase in carbon monoxide content of the atmosphere adjacent to the metal surface or because it tends to remove excess oxygen from the furnace gases and thus facilitates hydrogen absorption or alternatively decreases hydrogen elimination.

* * *

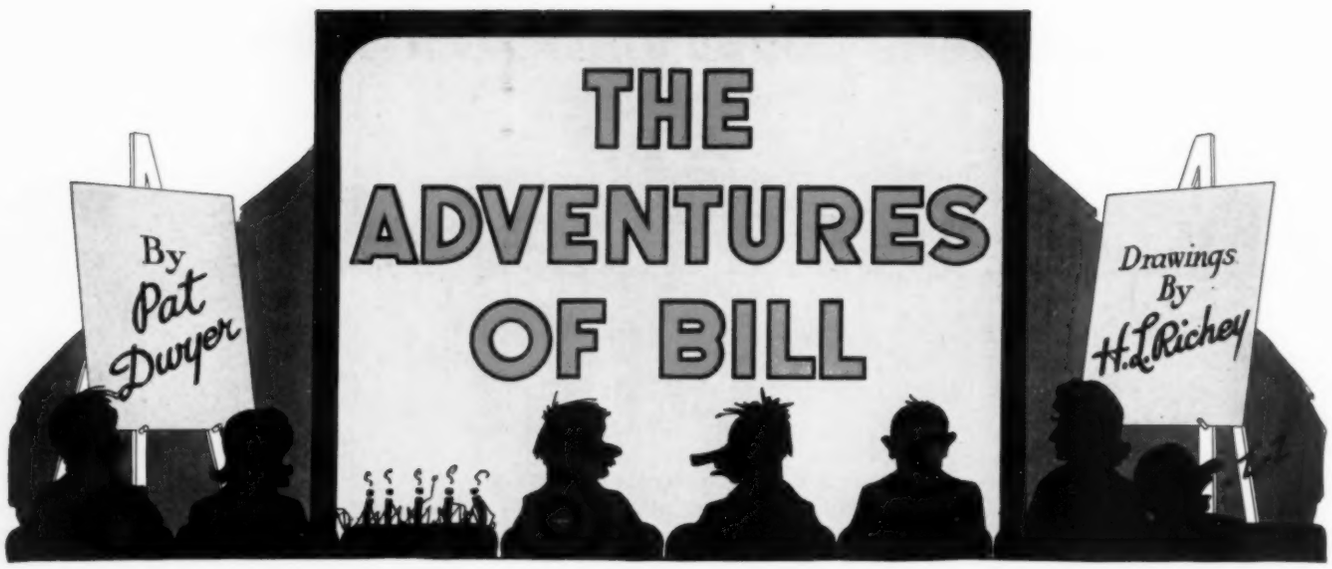
Active life of graphite or clay crucibles may be prolonged to a considerable extent it is claimed by painting the exterior and interior with sodium silicate or water glass. The solution is mixed with water in approximately half and half combination and applied with a paint brush. The crucible should be dry, but not hot, when the paint is applied. The coating is allowed to dry thoroughly before the crucible is placed in the furnace. The treatment seals checks and cracks, and prevents flaking through a glazed surface that withstands high temperature, and strengthens the crucible. The coating is as hard as glass, fireproof, and cheap.

* * *

ONE progressive foundry observing one of its customers spending considerable time and money in making a flanged gear out of tool steel, and fitted with a bronze bushing, suggested that it could be made of white iron which the foundry produced. The customer was willing so a few experimental gears were made using a cast-in gray iron rod to form the center, and a dry sand core to form the teeth. They gave excellent service, and the foundry obtained some worthwhile business.

* * *

An Eastern malleable foundry has placed on the market a line of pole reinforcers or stakes which may be used repeatedly, and are claimed to prevent wood telephone and telegraph poles from snapping at the ground line. Made of malleable cast iron, the supports are about 6 feet long, and approximately 4 feet of that length is driven into the ground. The stakes fit snugly against the pole, and are fastened by a steel band, or clamped with steel clamps.



DO YOU know," said Bill the other night, "I never realized until recently the extent to which the foundry business has been revolutionized during the past period of 40 or 50 years. Changes came about so gradually that the older men adapted themselves to them and younger men coming in took up the innovations and listened with amused tolerance to accounts of how difficult jobs were handled in the good old days. Mechanical equipment has been developed and installed to such an extent that a great deal of the former manual skill and dexterity, the inventive genius so highly developed in the old time molder, have almost passed out of the picture. Practically nothing is left any more to the individual molder's judgment. Sand mixtures are developed in the laboratory and a metallurgist decides on the composition of the metal. The molder has no say in the size or shape of the flask, position of gates and risers, or which side of the pattern is to be molded up or down. The shovel and the rammer have taken their place with old Uncle Ned's fiddle and hoe, and a complete kit of finishing tools is so rare that you could search every hock shop in town without finding one."

"And what, pray," I inquired, "brought all this to your mind recently?"

"Well," said Bill, "I'll tell you. I came across several bound volumes of the *Brotherhood of Machinery Molder's Journal* published in the late eighties and early nineties of the past century. This was the official organ of a molder's union confined exclusively to men who worked at the machinery branch of the trade and who carried a red card. Correspondence and editorial material throw an exceedingly interesting light on prevailing conditions at the period, but what struck me in particular was that practically all the technical articles dealt with some phase of molding practice, usually the ingenious method and equipment developed to cope with a difficult casting. Foundrymen of America owe a debt of gratitude to Robert E. Masters, Simpson Bolland, Thomas D. West and many other master foundrymen of the old school who generously placed the results of their researches at the disposal of neophytes on the long trail. Modesty prevents me from claiming that the old time foundryman was more intelligent than his modern successor, but I think I am safe in saying that he showed more ingenuity in wiggling out of a tight corner. Mention a typical instance? I could rake up 40 at a minute's notice.

"Away back in the good old days when most of the molders were skilled mechanics I worked in a foundry connected with an iron and steel making plant in a remote section of the country. Traveling members drifting in now and again and lingering for periods ranging from a week to 6 months brought rumors of molding machines, sand mixing machinery and other innovations in prominent foundry centers, designed to increase production with the aid of raw or in some instances semiskilled men. The natural spirit of exaggeration which seems to afflict all travelers, whether to the county seat or all around the world, led these wandering birds of passage to swear by all that was sacred and holy that they had seen bimbos putting up more work in a day than an ordinary man could put up in a week. At that time 30 snap flasks made on the bench was recognized as the standard day's work in every dog house from Maine to California.

Foundry Ulysses Returns to Ithaca

"These stories and the other usual run of mine stories dealing with the immense castings made by the narrator in foreign parts, castings which set the coke bed on fire and remained in a liquid state for 30 days—two 2-week pay periods—were accepted politely in public, but with mental reservations and a liberal dash or two from the salt shaker. Even the apprentice boys had learned to discount the story of the mold so large that two men on horseback, racing in opposite directions, were required to light the vents. Or the other somewhat similar mold into which an apprentice was lowered through one of the risers to search for a trowel or a pet lifter which the molder, checking up on the tools, suspected he had left in some obscure corner. The apprentice lost his way among the cores. With three ladles and a reservoir all ready to pour, the majority opinion favored going ahead. Metal can't be held all day and what's one half baked, bandy-legged apprentice more or less? Fortunately at the last moment the boy's voice was

(*Continued on page* 52)

SAVE 20% OF FACING COSTS

Use

CHARLEROI SEACOAL FACING!

Foundrymen praise this improved seacoal because of the remarkable results which it achieves. No surprise to its many users is the 20 per cent saving effected in facing costs because of its superb quality. Less is required, because it is screened to match sand grain size and therefore distributes more equably and effectively. CHARLEROI is made from the highest grade of Pennsylvania lump gas coal, famous for its volatile and carbon richness. Pulverized in frictionless grinders, it retains a maximum of volatile carbon. CHARLEROI is available in seven uniformly screened grades for every foundry need.

Shipped by the bag, ton or carload.

The Twist Does the Trick!

FEDERAL TWISTED STEM CHAPLETS

An ever-popular chaplet with foundrymen because fusion starts instantly at the thin and sharp edges of the stem. Electrically welded, leaks at the head are eliminated. A patented, quality chaplet available at standard prices in a wide range of types and sizes.

LOWE HIGH-SPEED RIDDLES

Light in weight, the improved Lowe Electric Sifter is one of the fastest foundry sifters available. Will handle efficiently 4½ tons of facing sand or 6 tons of oil-based core sand hourly and day after day. Its reasonable cost will surprise you. Fully guaranteed.

FEDERAL GREEN BOND

★ PURE WYOMING BENTONITE

After 12 years Green Bond is still the favorite and ideal bonding clay. By its use, permeability and green bond strength are controlled at will. Federal Green Bond develops the proper amount of dry strength to prevent "cuts," "washes" and other defects. Federal Green Bond (Wyoming Bentonite) by comparison will show 25 per cent greater durability than Mississippi or Alabama Bentonites. Thus: greater satisfaction, minimum losses and real economy.

★ SOLD WITH SERVICE

In addition the use of Federal Green Bond is fully license paid under U. S. Pat. Nos. 1657573, 1509406, 1509478 and Canada Pat. Nos. 249251, 249252.

The FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71st Street • Cleveland, Ohio

CHICAGO CHARLEROI, PA. DETROIT MILWAUKEE MINNEAPOLIS NEW YORK ST. LOUIS RICHMOND, VA. UPTON, WYO.

(*Continued from page* 50)

heard inquiring for the time. A rope was dropped through the opening and a dozen rough and toil worn hands pulled him to safety and he was docked half a day for loafing on the job.

"Investigators of folk lore and all that kind of stuff will find a relationship or resemblance between this legend and the perennial hospital story where a group of patients relate instances of instruments, sponges, clips, tools and other odds and ends inadvertently left inside when the doctor finished an operation and put a feather stitch and a flourishing bow knot, a kind of a signature in the incision. Imagine their consternation when a doc pokes his head in the door and inquires if any one has seen his hat lying around!

Looked Askance at Machines

"Back in this old time foundry, which by the way we considered pretty trappy and up to date at the time, we did not worry much about molding machines or other new fangled contrivances. All right for production shops running on a limited line of castings day in and day out, but without a ghost of an application in a general jobbing shop where the number of 1-off jobs was in the majority and where castings in the same heat might range in weight from chicken feed to 50 tons. Molders mixed their own facing and backing sand. They judged the strength and general workability of the molding sand by squeezing a ball in the hand. They tested the sea coal content of the facing sand by squeezing a handfull, rubbing it on the handle of the shovel and then noting the appearance of the shiny surface. Every molder had a helper, some young, some old and in greater variety of nationality than I ever encountered before or since. We did not have Parthians and Medes and Persians, strangers from Rome and beyond the Jordan, but we had them from every European country and from North and South America.

"My helper was Sam, a farmer man from Prince Edward Island. He was about 50 at the time, a real old age to my youthful eyes, but a positive treasure, shrewd, quick, adaptable and with the most amazing faculty for producing gaggers, soldiers, lengths of rails, clamps, blocks of wood, weights or anything else required in the day's operation. Apparently he had some form of secret understanding with the cranemen. I never had to wait for a lift.

Puts on the Brass Hat

"Following one of the many managerial shakeups from which the plant suffered in the early and formative years I was invested with a foreman's brass hat. The new master mechanic decided that instead of making the blast furnace runner troughs in the foundry, he would have them made in the pig bed at the blast furnace where they could be poured with direct metal. You know what these castings look like? Big, heavy blocks of iron about 3 feet wide, 2 feet deep and 5 feet long, shaped like a trough and with trunnions on the sides for handling. They are buried in sand at the point where the metal leaves the long runner in the pig bed and flows into a waiting ladle for transfer to the pig machine, the bessemer mixer, or the open hearth furnaces. Smoothness or general appearance is not a factor of any importance.

"The M. M. considered it would not be necessary to delegate a skilled molder on the job. 'Take one of the more intelligent helpers,' says he, 'and send him down. I'll raise his rate 50 cents a day. That will pep him up and I'll knock a few dollars off the cost of the castings.' Great lad for that kind of saving stuff.

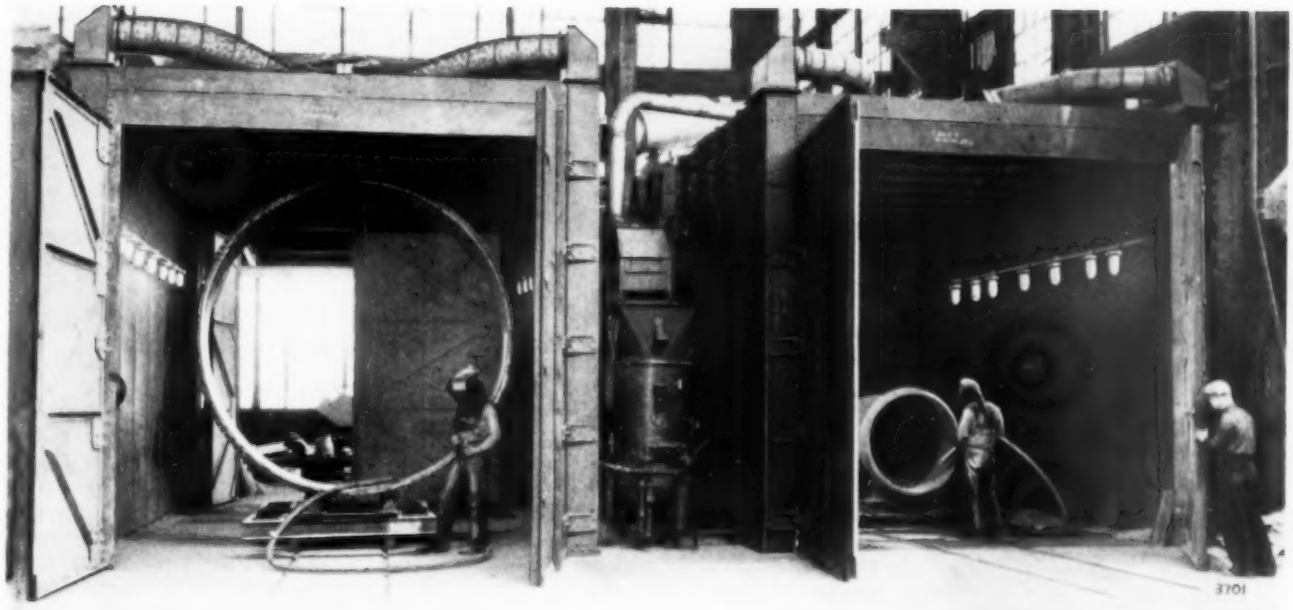
"In those days money in some mysterious manner had an elastic quality sadly lacking in more recent years. A 50 cent raise in the day's pay was regarded as a legitimate cause for family rejoicing and I experienced a reflected glow of pleasure in the opportunity of increasing Sam's stipend or honorarium to this extent. He was modestly diffident about tackling the job, but I assured him I had full confidence in his ability. The molds were comparatively simple, made in open sand without any copes. All he had to do was ram sand around the pattern, then pull the pattern out and build a channel from the long runner to convey metal into the mold. The little cores for the trunnions could be dried on a plate set up over the blacksmith fire. Incidentally, he burned the first half dozen before he learned how to prop them up at the proper height and how to turn them over after one side was sufficiently scorched. I gathered in a general way that Sam and the blacksmith had some interesting sessions discussing the finer points of the molding and blacksmithing arts. Sam was a wise old bird, not exactly as secretive as an owl, and yet on the other hand as you might say, not as gabby as a magpie. He was a good mixer and fitted into his place as readily as any other employe around the blast furnace.

Good News Travels Fast

"The foundry and the blast furnaces were nearly a mile apart and I had no opportunity to visit Sam for about a week. In the meantime I had no report of any kind and I naturally assumed that he was doing his work satisfactorily. Even in those early days I had discovered the important fact that good news

(*Concluded on page* 100)

Isn't the old doc a card! Always has a cheery word before applying the hatchet and saw



These two Sly Blast Rooms are used for blasting steel tanks and open sections before enameling. Note Sly Pressure Blast Tank between them.

GLASCOTE PRODUCTS, INC

MAIN OFFICE AND FACTORY 20900 ST. CLAIR AVENUE — EUCLID BRANCH P. O. — CLEVELAND, OHIO

September 15, 1939

The W. W. Sly Manufacturing Co.,
4700 Train Avenue,
Cleveland, Ohio.

Gentlemen:- Attn: Mr. J. Seiss

We are glad to tell you that the two 16' x 24' x 14' high Sly Sand Blast Rooms which you furnished and erected for us in April 1937, together with the Dust Filters, Pressure Blast Tanks, and other equipment, have given us splendid service.

We also appreciate the prompt and efficient service and the helpful suggestions which your organization has rendered us from time to time.

If you wish to show this Sand Blast installation to any of your prospective customers we would be glad to have you do so.

Yours very truly,

GLASCOTE PRODUCTS, INC.

BY: C. C. Pope
Secy. - Treas.

CCP:MH

Splendid SERVICE FROM SLY SAYS GLASCOTE

You, too, will experience the same satisfaction as did Glascote Products, Inc., when you buy Sly.

These two blast rooms—numbered among the largest in the country—incorporate the following features:

- Downdraft ventilation
- Clear vision
- Constant supply of cleaned abrasive
- Single lever blast control valves

They are carefully engineered to the exact needs and durably constructed for lasting satisfaction.

The accumulated experience of 65 years is at your disposal when you have a Sly man on your particular problem.

THE W. W. SLY MANUFACTURING COMPANY

4753 Train Avenue, Cleveland, Ohio — Branch Offices in Principal Cities

BLAST CLEANING EQUIPMENT — SLY — TUMBLING MILLS

DUST CONTROL EQUIPMENT FOR EVERY INDUSTRIAL PURPOSE

St. Louis HOLDS REGIONAL CONFERENCE

OVER 400 gray iron, steel and nonferrous foundrymen from the Southwest participated in the third annual regional conference arranged by the St. Louis Chapter of the A.F.A. The conference was held at the Jefferson hotel, St. Louis Oct. 5, 6, and 7. The first day was given over to registration and plant visitation with a stag smoker in the evening. First technical session was held Friday morning, Oct. 6 under the chairmanship of Lester N. Shannon, Stockham Pipe Fittings Co., Birmingham, Ala., and vice president of the A.F.A.

At a luncheon those attending the conference were welcomed by Lee E. Everett, Key Co., East St. Louis, and chairman of the St. Louis chapter. Speaker at the luncheon was Scott R. DeKins, secretary of the St. Louis chamber of commerce. Annual conference dinner was held Friday evening with Lee E. Everett as chairman. Brief speeches were made by Robert E. Kennedy, secretary of the A.F.A., and Lester N. Shannon, vice president of the A.F.A., who conveyed greetings of the national officers, and in turn introduced the speaker of the evening, Karl Landgrebe, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., who gave an interesting talk on the progressive South.

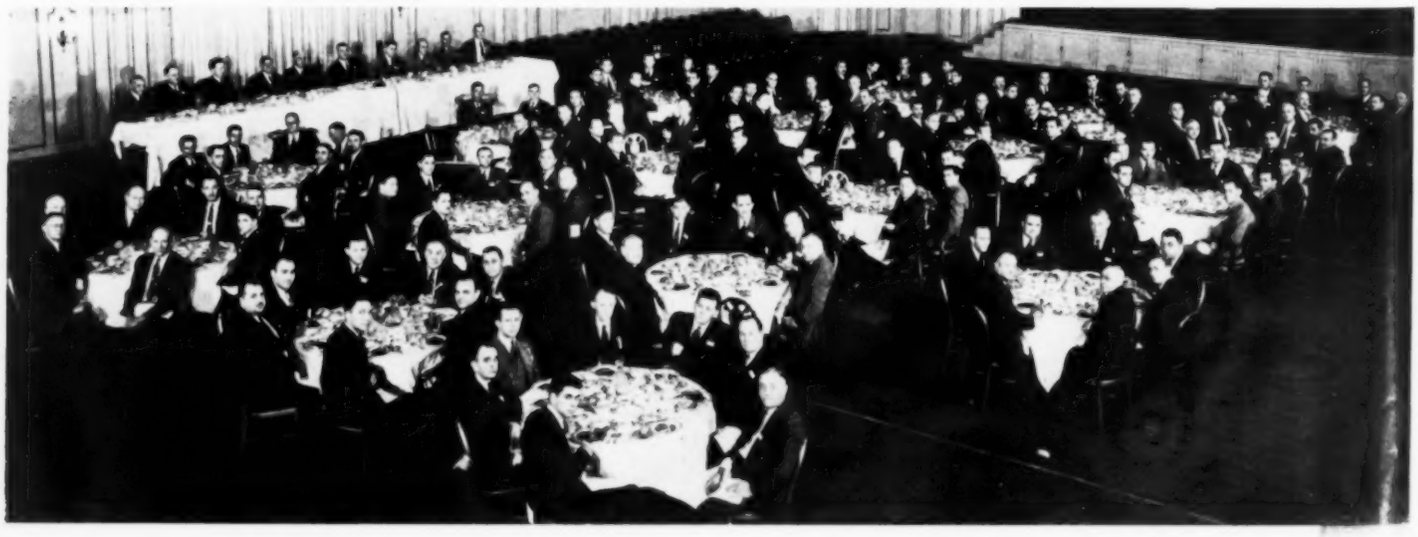
Opening technical session, held Friday morning, Oct. 6, with Lester N. Shannon presiding, was on the subject of design as related to casting problems, and concerned steel and gray iron castings. In the absence of C. E. Akers, Locomotive Finished Materials Co., Atchison, Kans., who prepared a paper on steel castings design, it was presented by Lee E. Everett. The author pointed out that since the engineer and the designer, as a general rule, are not as familiar as they might be with foundry phases of steel castings production, it is important that close and continual cooperation be maintained between the foundryman and designer to bring to the designer's attention things learned by the foundrymen through bitter experience.

It must be kept in mind that cooling rates vary over a wide range, and that gradual change of section thickness from a heavy to a light one will save much grief in the foundry. Mr. Akers included a number of illustrations to show how some difficulties could be eliminated by slight changes in design. For example, rounding off the corner on two sections which join to form a right angle will permit uniform cooling. Use of substantial fillets on interior angles is of great benefit. Another change in design which will pay dividends is to stagger the arms or sections which would ordinarily join at one point to form a cross or x-section.

It was pointed out that heat transmission of molding sand is comparatively low, and casting design should be such that nothing interferes with such transmission. For example if the heat transmission from a flat surface is considered as 1, the transmission of a 3-plane corner is only about 1/6 of that value or approximately 0.17. In some cases it is possible to aid heat transmission and reduce tendency toward hot spots by coring a small hole through one of the sections forming the 3-plane corner. The hole should have

(*Continued on page* 57)

Annual conference dinner at which Karl Landgrebe, Birmingham, was the principal speaker



(*Continued from page* 54)
the same diameter as the metal thickness and be located on a neutral axis as far as section stresses are concerned.

Difficulty was cited in producing cast steel sleeves 5 to 6 inches in diameter and ⅜-inch to 1-inch in metal thickness, which were machined inside and out, and then subjected to high pressure. It was found that the castings leaked in the central section when molded in the usual or vertical position. However, the difficulty was overcome by molding in the horizontal position, placing a head at one end and a chill on the other.

The second paper, relating to gray iron, was presented by E. B. Carpenter, American Car & Foundry Co., St. Louis. He stated that anyone familiar with foundry practice knows that the cost of a casting is related directly to the complexity of the casting, and the problems encountered in its production. However, the difficulty is that the designer has little if any knowledge of foundry practice, and usually, in designing a job, considers it first as a series of elements or masses which he later joins together to form a single integral casting. Hence Mr. Carpenter thought it would be well worth while if a pamphlet covering the more important features of design as related to gray iron castings were available at a low cost which could be distributed by foundries to designers and engineers.

Show Changes in Design

He has found it of decided advantage to suggest design changes and show the cost differential between the submitted design and the suggested changes. He believes it was well worth the time required to check the weights given on drawings and blueprints because often mistakes were made. Every foundry should insist on receiving good substantial patterns.

The speaker cited an example of what sometimes is submitted to the foundry with the expectations of receiving accurate castings. The particular job was that of a die block approximately 5 x 6 feet in which the pattern was constructed of ¼-inch plywood and 1-inch stock without proper support. It was so flimsy that it hardly could withstand its own weight and when that was called to the attention of the customer, he insisted that work proceed. While the foundry used as much care as possible, the casting naturally was overweight, and lacked an accurate contour so that the customer had to do considerable machining. However, since that time there has been close co-operation between the foundry and the customer in design and pattern construction for practically every job.

Mr. Carpenter gave several examples in which suggested changes in design proved advantageous to both foundry and customer. In one case the pattern called for a casting made in two pieces which were bolted together. Considerable breakage resulted due to improper design. The foundry suggestion that the job be made as a one-piece casting was followed, and that practice eliminated the breakage and also led to a reduction of 50 per cent in cost of the castings. In another case a large chemical kettle with a boss adjacent to a flange was changed in design so that the boss was cored. That equalized the metal thickness, eliminating the shrinkage at that point. He also called attention to the advisability of foundries keeping their eyes open to applications where castings could be substituted for other materials of construction.

Gray Iron Is a Family

In the discussion of the paper, C. R. Culling, Carondelet Foundry Co., St. Louis, pointed out that gray irons constitute a family rather than a single material, and that the design must be considered in relation to the particular type of iron which will be employed for the casting. Garnet P. Phillips, International Harvester Co., Chicago, said that too often the tendency of the foundryman is to grumble and growl about the pattern without going to the customer with suggestions on changes and reasons for such changes. His own opinion was that the customer usually would cooperate when he found out why changes in design should be made. Robert E. Kennedy, said that in welded fabrication each job was redesigned for that type of fabrication, and stated that the foundry should follow the same type of procedure.

N. J. Dunbeck, Eastern Clay Products Co., Eifort, O., discussed synthetic sands at the first session on Friday afternoon. He stated that synthetic molding sands cost from 60 to 70 cents a ton, and while requiring more mixing equipment and more control, they are coming more into use. Synthetic sands dry out more rapidly than natural molding sands.

According to Mr. Dunbeck, advantages of synthetic sands are low cost, lower moisture content, higher permeability, and greater flowability. In addition, synthetic sands frequently give better finish due to the possibility of employing finer grain sizes without decreasing permeability too much. The speaker stated that bonding clays used in synthetic sand fall in one of three classes which are the kaolinites or fireclays, montmoronillites or bentonites, and illites which are approximately halfway between the first two mentioned. Hence, in conducting tests on bonding clays it was necessary to know the particular type so that the proper conditions for optimum properties can be established.

In testing it is necessary to maintain a close control of moisture, and it is advisable to run a known standard at the same time for comparison of properties. In response to a question from the floor on a method to reduce the tendency to drying out, Mr. Dunbeck stated that use of about 1 pint of fuel oil to a mixer full of sand is of considerable value. The fuel oil is put in last, shortly before discharging the sand from the mixer. A question was asked about the tendency of certain bonding materials toward balling, and the speaker stated that kaolinites had more of a tendency in that direction than the other types, and the balling action also occurred with certain grades of sand.

Second paper in the session on sand was by Harry W. Dietert, H. W. Dietert Co., Detroit, and described the relation between casting defects and sand properties. According to the speaker, the mold requirements are that it be a permeable, resilient and refractory vessel. He then described the stages through which a mold passes at the time of pouring and setting of the metal, effect of moisture, clay content, and green strength, mold hardness, corecollapsibility, and relation of sintering temperature to refractoriness of a molding sand. Mr. Dietert amplified his discussion by presenting a number of slides, and by performing a number of sand tests with equipment manufactured by his firm.

Gate and Feed Castings

Following the general sand session, two simultaneous sessions on gating and feeding of steel and gray iron castings were conducted. The session on steel was directed by Chairman H. M. Rishel, American Steel Foundries, Granite City, Ill., while that on gray iron was directed by Chairman C. B. Shanley, Semi-Steel Casting Co., St. Louis. Speaker at the steel session was Anton Johnson, Oklahoma Steel Casting Co., Tulsa, Okla. He pointed out that gating and heading steel castings in a jobbing shop presents many problems because the foundry seldom is consulted before design and pattern are made. There are various ways of gating and all have their advantages.

He stressed the importance of the proper way of making gates, so that the opening is not too small

(*Concluded on page* 60)

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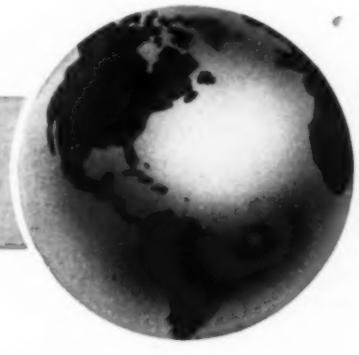


Time Proves Values

(*Concluded from page 57*)

and not too large, and also that it does not wash or cut. Mr. Johnson pointed out that the part of the casting which the metal enters will stay the hottest providing metal sections are uniform. If they are not uniform, shrinkage and cavity problems are increased. Therefore, it is important to determine where hot spots are likely to occur and locate the feed heads at such points. The gates should be kept as close to one of these as possible so that the head can feed both causes for creating hot spots. The speaker presented numerous illustrations showing the method of locating gates, risers, and pads which resulted in production of sound steel castings.

Speaker at the session on gating and risering gray iron castings was E. S. Clark, Banner Iron Works, St. Louis, who stated that there is no royal road to successful gating. There is no simple set of rules to be applied for successful gating. Several factors are involved including: Shape and size of the casting, sand conditions in the mold, flask size, and metal composition. Actual procedure is based upon experience and understanding of good design.

The gating system should be considered as a whole, rather than component parts, that is, as channels of flow from the point where the iron first touches the mold, to and including the cavity. Ladle size has an effect on design of gating system since it affects initial velocity and the possibilities of keeping the gating system full. To minimize temperature loss, short straight channels with small perimeters are desirable.

Need Large Risers

Mr. Clark stressed the necessity for determining the correct size and location of ingates, and figured that the riser sections should be equal to or larger than the section which is being fed from them. In his opinion better results were obtained where the metal can be gated directly into the riser and in such manner that the hottest metal reaches the riser. Sections of castings to be risered must be considered with the heat of the sand in mind. In some instances sharp wedges of sand are raised to high temperatures and retain that heat so that they act as a part of the section insofar as solidification is concerned.

In response to a question on the difference in gating for low carbon and the high strength irons as compared to ordinary iron, the speaker said that larger gates would be required so that the pouring time could be decreased. Where possible, the gate should enter into the riser or it might be advisable to pour directly into the riser. In response to another question from the floor on whether smaller risers could be used on nickel cast irons, Mr. Clark said that the answer would depend on the efficiency of the whole system, and if it were arranged in such a manner as to provide the correct progressive solidification of the casting, risers might not be needed at all. Mr. Clark believes the best results are obtained by the use of side risers rather than top risers since it appears to him that there was more possibility for spongy castings in the latter, due to the fact that the wedge of sand around the neck might form a hot spot.

On Saturday morning, Oct. 7, four simultaneous sessions were held. One was on gray iron under the direction of Chairman Carl Morken, Carondelet Foundry Co., St. Louis, another on steel over which Chairman F. X. Hahn, Scullin Steel Co., St. Louis, presided while a third on nonferrous castings was conducted by Chairman F. O'Hare, Central Brass & Aluminum Co., St. Louis. In addition to those technical sessions, a special student session was carried on under the direction of Chairman C. Y. Clayton, Missouri School of Mines and Metallurgy, Rolla, Mo.

Melting and Coremaking

The session on gray iron was divided into two parts covering melting practice and coremaking. The first speaker was Garnet P. Phillips, International Harvester Co., who discussed briefly the various phases of melting practice in cupolas and electric furnaces. Core making was discussed by Leroy P. Robinson, Werner G. Smith Co., Cleveland. The session on steel also was divided into two parts, one of which was a discussion of core and mold washes, by P. J. Dapkus, Decatur Milling Co., Decatur, Ill., and the other a talk on the application of internal and external chills by W. F. McKee, Key Co., East St. Louis, Ill.

Subject of the nonferrous meeting was defects in nonferrous castings which was discussed by Arthur Fritchle, Federated Metals division, American Smelting & Refining Co., St. Louis. Speaker at the special student session was C. R. Culling, Carondelet Foundry Co., St. Louis, who spoke on the general aspects of the foundry.

General chairman of the conference was Louis J. Desparois, Pickands, Mather & Co., St. Louis, and the technical program was arranged by a committee under the direction of Chairman Roy A. Jacobsen, Carondelet Foundry Co., St. Louis. Other members of that committee were L. K. Bartholic, St. Louis Steel Casting Co., St. Louis; E. A. Goerger, City Pattern & Model Works, St. Louis; George W. Haley, Century Foundry, St. Louis; C. H. Morken, Carondelet Foundry Co., St. Louis; Fred B. Riggan, Key Co., East St. Louis, Ill.; M. E. Stewart, Green Foundry Co., St. Louis; J. D. Walsh, Scullin Steel Co., St. Louis; C. R. Culling, Carondelet Foundry Co., St. Louis, and L. C. Farquhar, American Steel Foundry Co., Granite City, Ill.

Apprenticeship

The United States office of education and the federal committee on apprenticeship have prepared a statement explaining the apprenticeship program and indicating the separate and distinct responsibility and function of vocational education and labor department at both the state and federal level for carrying on the program. The discussion answers questions as to how the apprenticeship program operates, the part played by school, why labor department should promote apprenticeship, and why the labor and educational aspect of the program were separate.

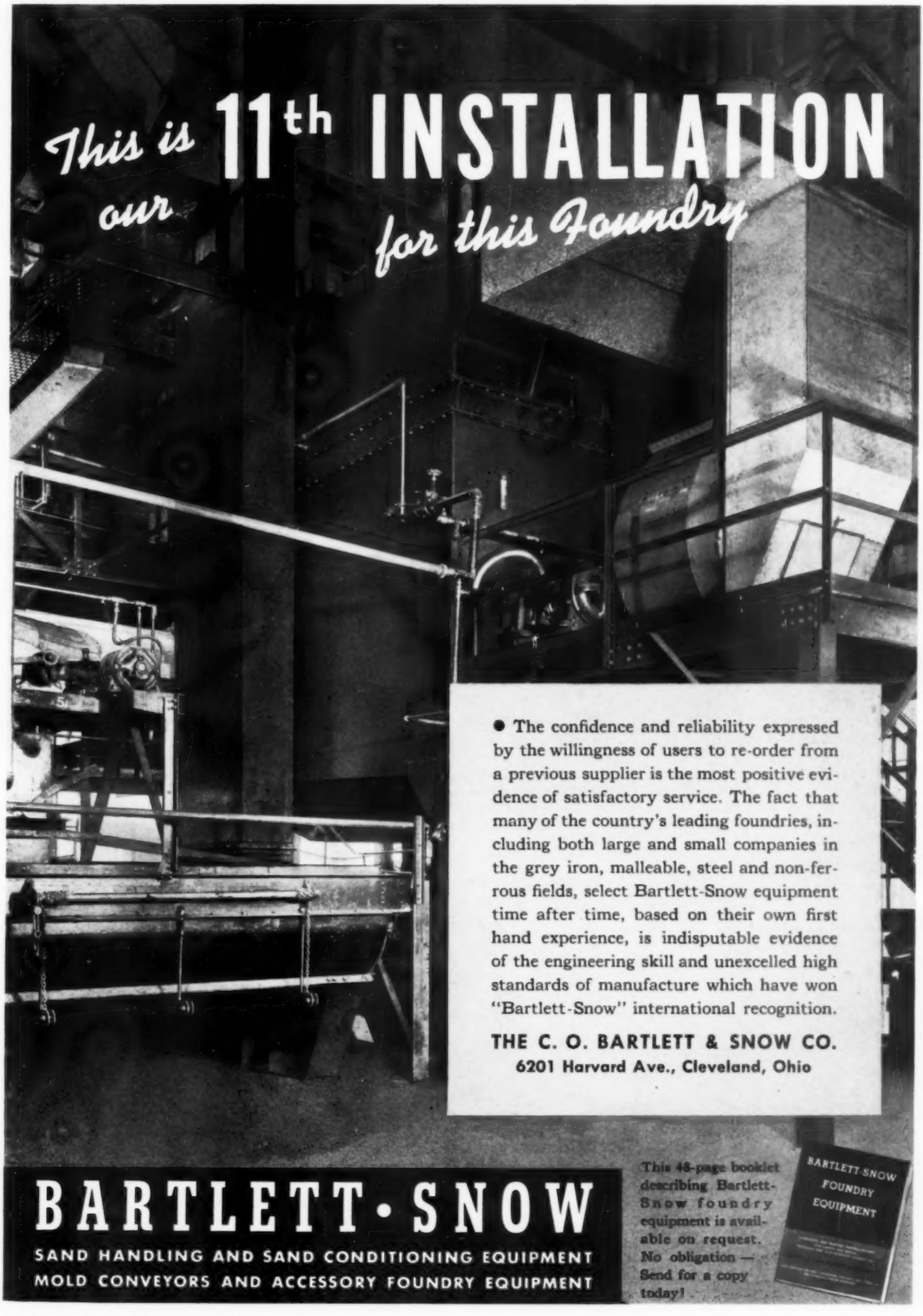
Copies of the bulletin may be secured from the superintendent of documents, Washington, for 10 cents.

Advertising Survey

National Industrial Advertisers association recently has published the results of a survey on the annual industrial advertisers budget. The report is broken down by product classification and by size of company, so that it is possible for the advertising sales manager to compare his own expenditures with those of other concerns of similar size and in the same general line of business.

The report gives the advertising expense in per cent of sales, also the total sales expense in per cent of sales and sales volume in per cent of plant capacity, all for the past 5 consecutive years. It also reveals interesting facts on relationship of advertising departments and agencies, methods of making up the advertising budget, etc. Copies may be obtained from the association, 100 East Ohio street, Chicago, for $2.00.

Chain Belt Co., Milwaukee, has acquired the business and all net assets of Baldwin Duckworth Chain Corp., Springfield, Mass. The newly acquired plants at Springfield and Worcester, Mass., will retain their identity and will be known as Baldwin-Duckworth division of Chain Belt Co.



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Northern Iowa

FIRST fall meeting of the Northern Iowa Foundrymen's association was held at Waterloo, Iowa, Tuesday, Sept 26, with approximately 75 members and guests present. Fred C. Nus, John Deere Tractor Co., Waterloo, and president of the association, introduced the evening's speaker, Judge George W. Woods of the district court.

Judge Woods, an outdoor enthusiast, has been a director of the Isaak Walton league for several years and has been active in conservation work. In relating his experiences the speaker stated that in view of the benefits he has derived personally from his outdoor activities, he believes that the social problems of a community would be benefited immeasurably by interesting more boys in those activities. He stated that his interest in conservation and stream pollution was not so much from the standpoint of personal enjoyment, but the community as a whole would benefit from that work. In closing Judge Woods again urged that boys be given an opportunity to spend their unoccupied time out in the open under proper guidance and counsel, rather than on the street corner.

Following the talk, moving pictures of several recent fishing trips to Canada and Northern Minnesota were shown by E. Jochumsen, Harmon Foundry Co., Waterloo, and E. Huss, Viking Pump Co., Cedar Falls, Iowa. In addition to fishing scenes, there also were shots of beautiful scenery in the lake areas and the highways in those areas.—*R. E. Wilke, secretary.*

Buffalo

REGULAR meeting of the Buffalo Chapter of the A. F. A. was held at the Hotel Touraine, Buffalo, on Oct. 6. Approximately 70 members were present. V. J. Wolfe, special agent of the Federal bureau of investigation presented the coffee talk and discussed the duties, qualifications and training of "G" men.

Frederick G. Sefing, International Nickel Co., New York, presented an interesting and instructive talk on, "The Influences of the Condition of the Molten Metal on the Properties and Soundness of Castings." A splendid discussion period followed Mr. Sefing's talk.

The next meeting of the chapter will be held on Nov. 17 and will be addressed by Harry W. Dietert, Harry W. Dietert Co., on the new developments in sand control.—*J. R. Wark, secretary.*

Conn. Nonferrous

THE first Fall meeting of the Connecticut Nonferrous Foundrymen's association was held at the Indian Hill Country club, New Britain, Conn., Sept. 20, H. A. Phelps, Phelps Foundry Co., Ansonia, Conn. and president of the association presiding. The speaker, D. F. Sawtelle, Malleable Iron Fit-

(*Continued on page* 66)

Views taken at meeting of New England Foundrymen's association held at Mystic Iron Works, New England Coke Co., and Warren Pipe Co. Left—Group from Mystic Iron Works including Messrs. Becker, Dragoon, and Drewson. Center—L. H. Goodnow, Goodnow Foundry Co., Fitchburg, Mass. Right—Group from General Fire Extinguisher Co., Providence, R. I. Photos courtesy C. A. Wyatt, Debevoise-Anderson Co., Boston

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(*Continued from page* 62)

tings Co., Branford, Conn., discussed, "Molding Sand Tests and Specifications."

Mr. Sawtelle told of the benefits of testing sand and of keeping the sand pile built up to a set specification. He pointed out the progress made in educating the old-time foundryman to the modern method of keeping sand piles under constant control and the benefits derived from that procedure.

In the afternoon a golf tournament was held under the direction of Walter J. Kenney, North & Judd Mfg. Co., and golf prizes were awarded to Charles Bertuccio, Howard Gillis and Louis G. Tarantino.—*Louis G. Tarantino, secretary.*

Ontario

WITH the thermometer soaring into the nineties, there was ideal weather for the picnic of the Ontario chapter of A. F. A. at Barnesdale, the estate of W. R. Barnes, W. R. Barnes Co., Ltd., near Waterdown, on Sept. 16. In spite of

Fred Stindt, Brooklyn, N. Y., and A. B. Root Jr., Hunt-Spiller Mfg. Co., Boston, at the New England outing

problems of adjusting business to a war economy, foundrymen and suppliers turned out to the number of about 100 to participate in a fine sports program and to enjoy the picnic supper at the close of the activities of the afternoon.

The sports program prepared by the committee, consisting of C. C. MacDonald, Frederic B. Stevens of Canada, Ltd., chairman; W. R. Barnes, the host of the occasion; N. B. Clarke, Steel Co. of Canada; and J. Reid, Canadian Westinghouse Co., Ltd., offered as its principal events rifle shooting, golf at Waterdown golf and country club, and horseshoes, with swimming and darts as side attractions. For those who wished to merely keep cool there were comfortable benches overlooking the little stream that flows through Barnesdale.

Following the picnic supper, prizes were distributed to the winners in the various events by D. J. MacDonald, chairman of the Ontario chapter. W. Metcalfe was first prize winner in the rifle shooting competition, with G. L. White second, and M. Davidson third. At golf, J. W. Watson had low gross, and J. E. Wagman low net, with a number of others receiving lesser awards on various counts. Winners in the horseshoe tournament were Fred Francis and J. Williamson. Numbers were drawn for several attractive attendance prizes.

With this very successful outing as an introduction to the fall season, the Ontario chapter is all ready to swing into its first regular meeting at Hamilton on Oct. 27.—*S. R. Francis, secretary-treasurer.*

Cincinnati

THE Cincinnati District Chapter of the A.F.A. held an interesting meeting Tuesday, Oct. 10 at the Union terminal. Following the dinner, Morris Edwards, executive vice president of the chamber of commerce presented an interesting and informative talk on the proposed Bigelow amendment to the Ohio constitution. All present were impressed with the seriousness of the issue, and all agreed to pass on to others the information presented.

Following intermission the business meeting was called to order by Herman Ewig, Cincinnati Milling Machine Co., and chairman of the chapter. Ten new members were presented and welcomed. The chairman called for a report of the auditing committee composed of the following three new directors: Frank Hutchinson, Reliance Foundry Co.; Charles Erhart, Chris Erhart Foundry & Machine Co.; and Herschel Kautz, Cincinnati Milling Machine Co. The report of the committee was accepted and the committee discharged with thanks.

The chairman then introduced the guest speaker, Sam Tour, Lucius Pitkin, Inc., New York, who presented an interesting discourse, "Cause of Defects in Ferrous and Nonferrous Castings." An interesting question and answer period followed the presentation of the talk.

The chapter has proposed a motor trip to Dayton, O., for the Nov. 14 meeting—*E. T. Korten, secretary.*

St. Louis

THE 1939-1940 activities of the St. Louis District chapter of A.F.A. were opened with a fine session on Thursday evening, Sept. 14 at the York hotel. The business session was opened under the chairmanship of L. E. Everett, 1939-1940 chapter chairman. After the reading of chapter minutes by the secretary-treasurer, various committee reports were requested.

Thomas Ross of the David Rankin Junior School of Mechanical Trades and chairman of the apprentice training committee, presented the A.F.A. token award to Charles Maul for winning a prize in the apprentice training contest at the Cincinnati convention of A.F.A. Mr. Ross then directed attention to the foundry course which is to be held during the winter at the Rankin school in co-operation with the St. Louis chapter.

The chapter then voted to hold another Kansas City extension meeting for the benefit of foundrymen in and around Kansas City at a time and place to be designated by the executive committee. Program committee report was presented by Webb L. Kammerer in the absence of W. Carter Bliss, chairman. An outline was given of the many activities to be presented to the chapter throughout the coming month.

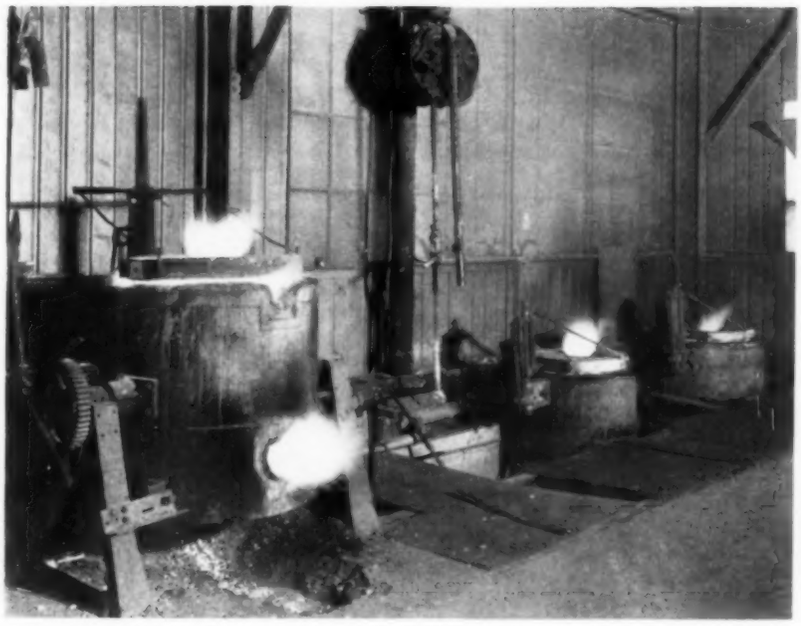
After welcoming of new members and guests the chairman then introduced E. O. Jones, treasurer and director of the safety and hygiene section of the A.F.A., who gave a most interesting talk on "Safety and Hygiene in the Foundry." A series of films loaned through the courtesy of the Hamilton Foundry & Machine Co. were shown to the group and very favorably received.

Judging by the attendance and

(*Continued on page* 68)

Nearly 100 members and guests attended the annual outing of the New England Foundrymen's association which was held at the Pomham club, Providence, R. I., in August. Photos courtesy C. A. Wyatt, Debevoise-Anderson Co., Boston

FLEXIBILITY FOR PROFIT



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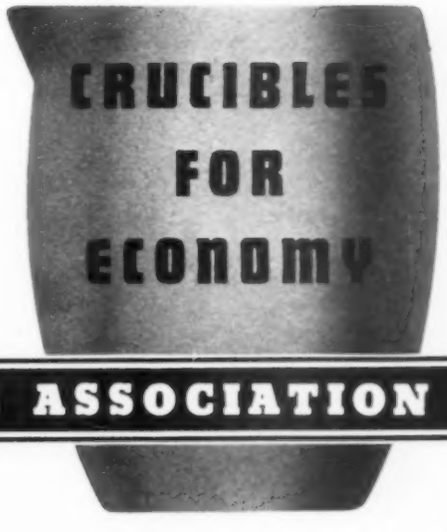

CRUCIBLE MANUFACTURERS ASSOCIATION

90 WEST STREET, NEW YORK, N. Y.

(*Continued from page* 66)

interest shown on this first meeting the St. Louis District chapter activities for the coming year will certainly be outstanding.—*J. W. Kelin, secretary-treasurer.*

Chicago

HERALDED as one of the largest social events in which foundrymen participate, the annual stag outing and golf party of Chicago chapter of the A. F. A. this year drew close to 800 foundrymen and members of allied industries to Lincolnshire country club, Sept. 23. This was several score in excess of last year's attendance, as the annual gathering of the clan is growing larger yearly.

Activities began early in the morning, there being a choice of three golf courses until 9:30 a.m., and after that No. 2 course reserved for the exclusive use of the guests. With its uncanny weather eye, the committee again picked a fine outing day and those participating in golf totaled 380. This was the chief diversion till late in the afternoon, when the feature became a championship softball game between two top-flight girls' teams, the Parichy Bloomer Girls and the favorites of last year's outing, the Rival Dog Foods, an affair of particular interest to the numerous sideline coaches in the foundry industry. At the same time, the annual horseshoe pitching contest drew the attention of barnyard enthusiasts.

Climax of the party was reached as usual during the dinner served to over 730 guests in the large tent. This lively 3-hour event involved awarding of door, golf and horseshoe prizes, following which came the floor show.

The party was engineered by the entertainment committee of the chapter, with P. V. Martin, Carnegie-Illinois Steel Corp., as chairman, and H. E. Cullen, Carnegie-Illinois Steel Corp., as secretary of the outing committee.

Settling down to the more serious business of the fall season, the chapter held its first fall meeting at the Medinah club, Chicago, Oct. 9. Dinner at 6:30 and business meeting at 8:00 were well attended. Chairman C. E. Westover, Burnside Steel Foundry Co., outlined the chapter's program for the season, mentioning a number of events not included on the printed program, such as the lecture course, and the regional conference to be held Nov. 9-11 at the Museum of Science and Industry, Jackson Park, Chicago.

Speaker of the evening was Dr. Phillip Fox, director of the Museum of Science and Industry, who told the inside story of the museum, its development, history and ultimate objective. He pointed out that the museum building, now housing the foundry exhibit, is considered the greatest architectural beauty since the Parthenon. Originally it was a museum of fine arts during the 1893 Columbian Exposition, later the Field museum, then for many years abandoned and vacant. In recent years it was reconstructed and made a permanent structure with the idea of making it an art and sculpture center. Out of this developed the scientific and industrial angle, and today the museum is devoted exclusively to this field. Foundrymen from other districts will be given an opportunity to tour the museum's nine miles of exhibits during the regional conference this month.—*J. F. Powell*

Reading

FIRST meeting of the fall season was held by the Reading Foundrymen's association at the Wyomissing club, Reading, Pa., on Tuesday evening, Sept. 19. Fifty foundrymen from the district in attendance. Paul Lane, research engineer, the Koppers Co., American Hammered Piston Ring division, Baltimore, Md., addressed the meeting on "Wear of Gray Iron." Mr. Lane used a number of slides to illustrate his talk, which was followed by a very interesting discussion.

It was first pointed out that the wear of any material is largely a question of its service environment. Examples were cited to show that hardness is often a poor measure of wear resistance. Materials such as hard rubber, bakelite, soft carbon, babbitt, fiber and others, may cause high wear of the harder steel surface against which they run. Attention was called to the fact that in considering wear, we normally are interested in results on both rubbing surfaces.

Nature of cast iron, from a structural viewpoint, was reviewed and it was stated that the presence of graphitic carbon, together with the irregular hardness of the various micro-constituents gave cast iron its smooth free-running qualities. The speaker's method for testing wear

(*Continued on page* 70)

Nearly 800 members and guests attended the annual outing of the Chicago chapter

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OR SINGLE UNITS

No. 1 portable sanditioner in action. Foundry built for foundry service.

No. 3 semi-portable sanditioner with gravity bucket feed.

Jeffrey flask tiller—overhead bin type with revolving boom. A mold conveyor installation is shown below.

(*Continued from page* 68)

resistance of various irons was described. Several examples illustrated that with certain types of structures, an iron of high hardness and dense fine grain, may show faster wear than a softer, coarser grain material. It was pointed out that the section size or cooling rate is a major factor in determining wear resistance, since this in turn determines the resultant grain size of the structure, together with the graphite form and distribution in the iron.

Examples of good and poor wearing structures taken from production castings served to show that many factors, including chemical analysis, melting practice, and design, all play their part in determining relative resistance to wear. A chart showing effect of annealing gray iron, indicated that at temperatures of over 1000 degrees Fahr., greatly increased rates of wear would be expected. It was mentioned that in general, (though there are always certain exceptions) phosphorus as well as sulphur seem beneficial from a wear viewpoint. Also it was stated that irons having a total carbon in the range of 3.25 to 3.50 per cent often show optimum wear qualities. A detailed graph, showing the effect of various alloys and alloy combinations on wear resistance, was discussed in detail, and the speaker stated that a study of the benefits of various alloy additions could be made only by considering a given section size. This is necessary because the same iron poured in different sections, will of itself show very different wear results. Thus in studying the effects of alloys, it is not logical to compare different sections.

In summarizing the talk, the speaker pointed out that other factors besides weight loss or change in dimension, must be considered in detail in evaluating a material for overall wear performance, since some irons show an increased tendency toward scuffing and scoring, and also a wide difference in the amount of wear thrown on the contact or opposite rubbing surface.

In conclusion, it was pointed out that wear resistance of any material is not an inherent characteristic and that the work reported has been carried on mainly with the idea of obtaining a better understanding of the nature or mechanism of wear rather than with the idea of assigning an arbitrary wear value to any given iron or type of structure.

Plans are being made for a Christmas meeting on Tuesday, Dec. 12, at which time the evening will be devoted solely to entertainment.—*H. C. Cummings, secretary.*

Quad City

QUAD-CITY Chapter of the A.F.A. held its regular meeting at the Blackhawk Hotel, Davenport, Iowa, Sept. 18. Bob Feeney, Davenport, presented an interesting coffee talk on experiences in writing a column for a newspaper.

The speaker of the evening, Edward C. Hoenicke, Eaton-Erb Foundry Co., Detroit, was introduced by A. E. Hageboeck, Frank Foundries, Moline, Ill. Mr. Hoenicke discussed, "Permanent Mold Castings," and presented interesting information on the development of permanent molds in a variety of applications. He stated that the use of permanent molds has made steady progress and that many advantages are found in that type of casting.

The speaker told of the design necessary in making the actual castings and molds. This is an important factor because of the work done by the mold in pouring the castings. Advancement of equipment used in that type of foundry practice was illustrated by slides and by an exhibit of castings. The discussion period developed many questions of considerable interest.—*J. Morgan Johnson, secretary-treasurer.*

New York-New Jersey

UNDER the guidance of chapter chairman W. E. Day Jr., Mack Mfg. Co., the 1939-1940 season of the Metropolitan New York-New Jersey chapter of the A. F. A. was ushered in successfully by an enthusiastic meeting of some 60 members and guests at the Essex House, Newark, N. J. on Oct. 2. J. S. Vanick, International Nickel Co., acting as technical chairman, introduced the guest speaker R. G. McElwee, Vanadium Corp. of America, Detroit, who gave an enlightening talk on the subject of alloying cast iron.

Mr. McElwee enumerated the properties conferred upon cast iron by the common alloys, grouping them according to their effect on carbides. He listed silicon, nickel, copper, manganese and titanium, the latter two when used in small quantities, as graphitizers, and chromium, molybdenum, vanadium—and manganese and titanium in quantities above .75-1.0 per cent—as carbide stabilizers. Vanadium, like titanium, produces a dual effect, small amounts deoxidizing and reducing chill and larger amounts strongly stabilizing carbides.

The speaker defined a further group of alloys or alloy combinations as process alloys—those which are used not to blanket the effects of other alloys but to prepare a more suitable base iron through the medium of deoxidation. The primary requisites for such a material were quoted as follows: (a) adequate chemistry to suitably and completely remove dissolved oxygen and nitrogen (b) proper mechanical form to insure intermixing and diffusion (c) formation of a fluid end-product which can be freed from the bath (d) lack of harmful effects when present in excess (e) high efficiency and low cost. Mr. McElwee pointed out that the Vanadium Corp. has been successful in preparing an alloy of that type which is in present use in several large foundries. The material contains 50 per cent chromium, small amounts of silicon and manganese and an accelerating agent such as calcium, barium, strontium or titanium, a combination designed to act as a strong deoxidizer but to have no effect upon the carbide stability. Data were presented to show that the addition of half of one per cent of that material to the ladle or spout was effective in reducing the chill of an automotive gray iron by as much as 50 per cent without altering the hardness of a 1.2-inch diameter test bar.

Following the interesting and highly informative talk a lively discussion ensued. The meeting was adjourned with the showing of an excellent film "Heat and Its Control" by representatives of the Johns-Manville Co.

The next monthly meeting was announced for Nov. 6 at which time Paul S. Lane, American Hammered Piston Ring Co., Baltimore, will talk on the wearing properties of cast iron.—*K. A. DeLonge.*

New Jersey

USE of copper in cast iron was discussed by Tom Barlow, metallurgist, Copper Iron & Steel Development association, at the first fall meeting of the New Jersey Foundrymen's association, at the Downtown club, Newark, N. J., Oct. 9. Approximately 90 were present. The association passed a resolution favoring the restriction of scrap sales abroad, it being brought out that an acute scarcity of leading grades of scrap had developed in the district.

Having devoted his time to research in the use of copper in cast iron and steel for the past 3 years, Mr. Barlow discussed results of various tests and applications under practical working conditions. Some of his observations were that copper increases the density in heavy sections while decreasing chill in the light sections, and that as cop-

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ADVERTISING PAGES REMOVED

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per is not lost through oxidation, it increases control over chemical analysis. Copper reduces the mottle section of cast iron more rapidly than it does the chill section and does not "open up" the unchilled sections, he also declared.

Discussing copper as a strengthener, he pointed out that higher percentages yield increases up to 15,000 pounds per square inch. When used to replace part of the silicon to obtain a given machinability, copper shows definite strengthening effects, even in the lower percentages. Copper also increases the physical properties of other alloy irons and at the same time increases machinability and decreases chill. In spite of the fact that copper decreases chill, it materially increases the brinell hardness and wear resistance of heavy sections without reducing the machinability. This is due, he said, to its effects on the matrix. He presented various typical analyses showing the use of copper with chromium, molybdenum, chrome molybdenum combination, vanadium and nickel, discussing advantages and particular applications.

The speaker said that normal foundry practice need not be changed to utilize copper. He pointed out also that copper should not be used in excess of 3.5 per cent, unless accompanied by large percentages of nickel. Copper is best added to the cupola spout, although it can be added to the base of the metal stream in the ladle, if necessary. Hot iron of 2700 degrees Fahr. or more is desirable and he recommended that copper shot should be used for spout additions and sheared cathode copper or heavy scrap for furnace additions. —*B. K. Price.*

N. Ill. and S. Wis.

A DISCUSSION of, "Core Room Practice," by Leroy P. Robinson, Werner G. Smith Co., Cleveland, featured the regular meeting of the Northern Illinois and Southern Wisconsin Chapter of A. F. A. held at the Faust hotel, Rockford, Ill., Sept. 12. Mr. Robinson presented an interesting talk on various problems encountered in production of cores. The speaker brought out the variables in the core room that must be controlled to produce uniformly good cores. The variables include sand, binder, oil ratios, moisture, mixing, baking and the human element. The speaker covered the subject thoroughly and quoted from his long experience to bring out the various points. The interesting talk was followed by a lively discussion which featured such topics as mixing sequence, mixing equipment and oven equipment.

Job evaluation was the subject discussed at the regular chapter meeting held at Hotel Hilton, Beloit, Wis. Oct. 10. C. J. Landstrom, Sundstrand Machine Tool Co., Rockford, Ill., and chairman of the chapter presided at the meeting which 65 members and guests attended. C. V. Nass, Fairbanks, Morse & Co., Beloit, presented motion pictures which he took in the Spring at the chapter's picnic. E. L. Roth, Motor Castings Co., Milwaukee, presented the system of job evaluation used by his company, and with the use of slides presented the system in detail. Mr. Roth brought out that it was important to evaluate the job and not the man. Since the system has been in use, the company has had little labor trouble. Activities of the chapter for the remainder of the year are as follows:

Nov. 13, Freeport, Ill., A. J. Busch, Charles C. Kawin Co., Chicago, "Defective Castings — Causes and Remedies."

Christmas party will be held in Rockford in December, the date to be announced.

Jan. 9, 1940, Rockford, "Automatic Cupola Operation by Means of Controlled Combustion," by S. C. Massari, research director, Association of Manufacturers of Chilled Car Wheels.

Feb. 13, Rockford, a round table meeting, subjects to be announced.

March 21, Rockford, "Safety Methods in the Foundry," H. W. Lundin, engineering department, Liberty Mutual Insurance Co.

April 9, Freeport, "Foundry Refractories," by C. E. Bales, Ironton Firebrick Co., Ironton, O.

May 14, Beloit, "Nonferrous Foundry Practice," C. O. Thieme, chief metallurgist, H. Kramer & Co., Chicago.

June will be the month for the annual picnic, date to be announced. —*H. C. Winte, technical secretary.*

Northeastern Ohio

NEARLY 100 members and guests attended the October meeting of the Northeastern Ohio chapter held at the Cleveland club, Cleveland, Oct. 12. Following the dinner, Chapter Chairman Ernest F. Hess, introduced chairmen of the various committees for the year 1939-40. These included Ray Fleig, Smith Facing & Supply Co., Cleveland—program; Walter Larson, W. O. Larson Foundry Co., Grafton, O. —membership; Ben Lambert, Diamond Alkali Co., Cleveland—greeting; L. P. Robinson, Werner G. Smith Co., Cleveland — entertainment; and Jim Goldie, Cleveland Trade school, Cleveland—apprentice training.

Following introduction of committee chairmen, Chairman Hess called upon Mr. Robinson to present the A.F.A. certificates of award to the several apprentices in the Cleveland district who were prize winners in the national contest held at the annual convention in Cincinnati in May. These included George Gedeon, Motor Patterns Co., first in patternmaking; Joseph Wyban, Gluntz Brass Foundry Co. Inc., first in nonferrous molding; Stanley Burford, second in nonferrous molding, and Joseph Birkenhur, Crucible Steel Casting Co., first in steel molding.

Prof. J. R. Strobel, University of Akron, Akron, O., presented an interesting coffee talk on apprentice training. He pointed out that some few years ago there were approximately 6,000,000 skilled workers with 90,000 apprentices, but at present, there are only about 37,000 apprentices which calls for some serious effort and consideration. He stated that the guild system of training actually was a preparation for life, rather than just a trade training, and today, while many features of the earlier craftsman training have been relegated to other sources, there are a good many others that still should be kept in mind when training apprentices.

Prof. Strobel pointed out that the employer engaged in training apprentices obtains a young man or boy who is willing to listen, and thus secures the benefit of experience of the older, skilled men. Also, he obtains an individual who is able to distinguish between the immediate advantages, and those which are less obvious. The apprentices are boys who appreciate the economic advantage of training and possess a high degree of integrity. They are loyal, and have the ability to co-operate and get along with people. The apprentice has faith in his superior and is interested in continuing his study. Last but not least, the apprentice possesses diligence and the ability to apply himself to work.

Main speaker at the meeting was C. E. Bales, vice president, Ironton Firebrick Co., Ironton, O., who discussed, "Refractories for the Iron Foundry." Mr. Bales began with a brief description of the production of modern refractories beginning with the mining of clays and ending with the final product. He then discussed refractories for the cupola pointing out that the furnace may be divided into four sections which comprise the zone above the charging door, the zone between the charging door and the top of the melting zone, melting zone proper, and the crucible. In the area above the charging door, conditions are not severe, and the lining only needs to protect

the shell from hot gases. The zone between the charging door and the top of the melting zone is subject to severe abrasion while the melting zone must withstand intense heat, action of molten metal, slag and fluxes. It also must withstand the cutting action of the blast, breakage due to chipping during patching, and if operation of the cupola is such that the lining must undergo temperature changes, it also must withstand thermal shock. The crucible lining must withstand corrosive action of molten metal, especially if it is highly oxidized, and spall resistance may be necessary if sudden temperature changes occur.

According to Mr. Bales, the present day machine-made cupola blocks are dense and hard, and readily resist abrasion action of the molten metal and slag. Proper grain size and material control gives the machine-made product spall resistance in spite of its density. Use of fused soda ash in foundries has led to the use of plastic refractories for ladle linings which possess several advantages. The plastic refractory has practically no drying or firing shrinkage, and forms a uniformly hard refractory lining.

In the discussion which followed Mr. Bales' talk, a question was asked on why difficulty in burning out should be encountered in a malleable air furnace used in duplexing where alumina brick were used in the bottom, and fire brick in the side walls, unless the alumina brick were carried up well above the slag line. Mr. Bales said that there should be no trouble since there is no reaction between the two types of bricks, but without more definite knowledge on the various factors involved, it would be difficult to give the reason for the trouble. He also said that excellent results were being obtained in malleable furnace with the two layer bottom composed of a first layer of good fire brick upon which was laid a layer of super duty fire brick. A question was asked on why cupola block fuse more when high coke splits are used, and the reply was that the fusion resulted from the combination of a reducing atmosphere with high temperature.—*Edwin Bremer.*

Works Progress administration recently has published its marketing laws survey giving comparative charts of state statutes illustrating barriers to trade between states. The data deals with motor vehicle laws, dairy laws, oleomargarine laws, livestock and general food laws, nursery stock laws, liquor laws, taxes and general preference laws. The publication may be obtained from the superintendent of documents, Washington, for 25 cents.

National Founders Plan Meeting

Annual meeting of the National Founders' association will be held at the Waldorf-Astoria hotel, New York, Nov. 15 and 16. A meeting of the administrative council and the alumni dinner will be held on Nov. 14.

The session on Wednesday, Nov. 15 will include the report of the Commissioner A. E. McClintock, an address by Franklin R. Hoadley, Atwood Machine Co., Stonington, Conn., and president of the association, and addresses by John C. Gall, counsel, National Association of Manufacturers, the Honorable Millard E. Tydings, United States senator from Maryland, and Ralph Flanders, president, Jones & Lamson Machine Co., Springfield, Vt. The speaker at the luncheon on Wednesday will be William B. Stout, president, Stout Engineering Laboratories, Dearborn, Mich., who will talk on "The Second Coming of Aviation."

The program on Thursday morning, Nov. 16 will include a paper, "Powdered Metallurgy," by Gregory Comstock, New York.

Foundry Equipment Makers Meet

P. J. Potter, vice president, Pangborn Corp., Hagerstown, Md., was elected president of the Foundry Equipment Manufacturers' association at the annual meeting held at White Sulphur Springs, W. Va., Oct. 6 and 7. Thomas Kaveny Jr., vice president, Herman Pneumatic Machine Co., Pittsburgh, was elected vice president and Arthur J. Tuscany, Cleveland, was re-elected executive secretary. New members of the board of directors include: E. O. Beardsley, president, Beardsley & Piper Co., Chicago; B. C. Trueblood, treasurer, Arcade Mfg. Co., Freeport, Ill.; and Thomas Kaveny Jr.

The 2-day program included a discussion of present day business conditions in the equipment industry and possible future trends. All members present indicate business improved to a marked extent during September and said prospects for additional purchases of equipment in the foundry industry during the next few months appear bright.

C. E. Hoyt, executive vice president, American Foundrymen's association, Chicago, discussed, "The Common Interest of the Foundryman and the Foundry Equipment Manufacturer," and James R. Allan, assistant manager, industrial engineering and construction department, International Harvester Co., Chicago, and chairman of the hygiene codes committee of the American Foundrymen's association, presented an interesting discussion on "A User's Observations Regarding the Foundry Equipment and Supply Industry."

W. R. Bean, vice president, foundry equipment division, Whiting Corp., Harvey, Ill., described his impression of conditions in England and the continent as gained during an extended trip made immediately following the International Foundry Congress in London.

Insurance Company Is Licensed

E. O. Jones, president and treasurer, Founders Mutual Casualty Co., Chicago, has announced that the company has been licensed by the director of insurance of the state of Illinois.

The new insurance company is the outgrowth of a co-operative enterprise on the part of a group of foundry operators, who, in 1936, found it necessary to band together to provide themselves with insurance under the Illinois occupational diseases law.

Roger Bronson is vice president of the Founders Mutual Casualty, and R. D. Phelps, president, Francis & Nygren Foundry Co., Chicago, is secretary.

Book Review

Standard Chemical and Technical Dictionary, by H. Bennet, 638 pages, cloth, 6½ x 9¼, published by the Chemical Publishing Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $10.00.

This book is a condensed technical dictionary for students, writers, technicians, engineers, scientists, and others needing assistance in keeping up with the many new chemical, physical, mathematical, engineering and technical words of expression. The 25,000 definitions cover industrial products, chemicals and trade names, abbreviations and contractions as well as symbols used in mathematics, chemistry, thermodynamics, pharmacy, etc.

The contents include: Introduction to the use of the dictionary, nomenclature of organic compounds, prefix names of organic radicals, abbreviations and contractions, dictionary covering chemistry, physics, biology, mathematics, engineering and technology, together with a section devoted to Greek, mathematical, apothecary and miscellaneous symbols.

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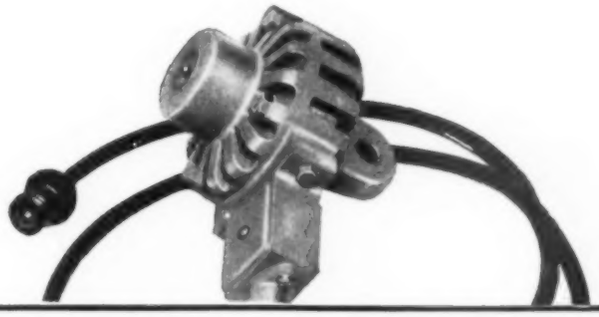

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No. 1—Light match plate work	$10.00	No. 5—Heavy match plate, tub, bench	$17.00
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AMONG DETROIT FOUNDRIES

By A. H. ALLEN
Detroit Editor, The Foundry

FOUNDRYMEN these days have to be economists as well as technicians, in view of the pronounced effect of the European war and the increase in domestic business on such items as raw material costs and the like. In recent weeks the price of scrap has advanced sharply, in some grades as much a $5 and $6 per ton, or around 25 to 30 per cent. Foundries buying scrap on the outside are faced with increasing the price of their castings or of discovering some method to circumvent this price boost. Of course, the present price of scrap will result in the greater use of pig iron, which has not advanced so sharply, in the charge.

Currently, heavy breakable cast scrap is being quoted in Detroit at $14.50-$15.00 per ton; No. 1 cupola at $16.50-$17.00; new heavy auto cast at $17.50-$18.00; short rails at $24.50-$25.00; and low-phosphorus plate or punchings at around $19.00. These are dealers buying prices and to them must be added delivery charges of about 50 cents to a dollar per ton.

Face High Scrap Prices

At the middle of October, some easiness developed in scrap prices, no doubt because of the too-rapid advance in weeks previous. Unfortunately, cast grades did not share in this weakness as much as the steel grades. High rate of steelmaking operations and comparative shortage of good scrap are two factors which lead many to believe the scrap market will continue strong for some months to come and will continue to present a problem for foundrymen who have none too great a margin between cost and selling price anyway.

The large captive or automotive foundries, using mostly scrap originating in their own plants, are not faced with this problem as much as are the smaller, independent melters. Nevertheless the former are buying unusually large tonnages of scrap, indicating they expect the market to continue higher. One foundry in this district, which normally buys scrap in the open market in lots of around 2500 tons, recently made inquiries for 10,000 tons.

Foundry business in general is improving in the Detroit area, though probably not to the extent of other lines. Agricultural implement manufacture is strong, implying a good need for cast parts. Railroads finally have come into the market for new cars and other equipment, which should improve vastly the position of foundries supplying railroad castings.

Adopts Duplexing Process

Ford is pushing tractor production and is understood to have reached a production level of 50 units per day. This tractor, it will be recalled, is about three-fourths castings and the Ford foundry is humming to keep up with demand for these parts.

New duplexing process for production steel for castings has been perfected by the Auto Specialties Co., St. Joseph, Mich., and experiments are being carried out in adaptation of the metal to a number of automotive parts, with reported highly successful results. The process involves melting a high-carbon, high-silicon, high-manganese iron in a cupola and charging the hot metal into an electric furnace bath of low-carbon wild steel prepared by melting steel scrap. Endothermic reactions occur between the cupola metal and the slag on the electric furnace melt, and the resultant metal is exceptionally fine-grained and shows high physical properties.

The material is of the type as that used in Ford pistons and crankshafts, known variously as cast steel, semisteel, border-line steel, etc. Typical analysis is 1.50-1.65 carbon, 1.10-1.30 silicon, 1-1.20 nickel, 0.30-0.40 manganese and 0.20-0.30 molybdenum. It exhibits high tensile strength, high torsion strength, good damping qualities, good susceptibility to heat treatment and other qualities suggesting a superior material for uses such as gears, crankshafts, etc.

Castings Used Extensively

Castings figure prominently in the new Olds hydra-matic transmission which, by a combination of fluid flywheel or clutch and planetary automatic transmission permits dispensing with conventional clutch pedal and gearship lever. Housings for the gear sets and fluid clutch, of course, are cast, as are the ring gears and drums in the planetary assemblies, of which there are three, two for forward speeds and one for reverse. Rotation of the ring gears is controlled by automatically-applied brake bands acting on drums. Cast iron has shown itself an ideal material for brake drums and hence is well suited to use in these parts of the transmission.

Shifting from one gear ratio to the next is controlled hydraulically through a system of pumps, governors, clutches and other units, so that as the car speed increases the

(*Concluded on page* 78)

SPO TALKS PRACTICALLY

A frankly literal record of a foundry situation—and how it was handled.

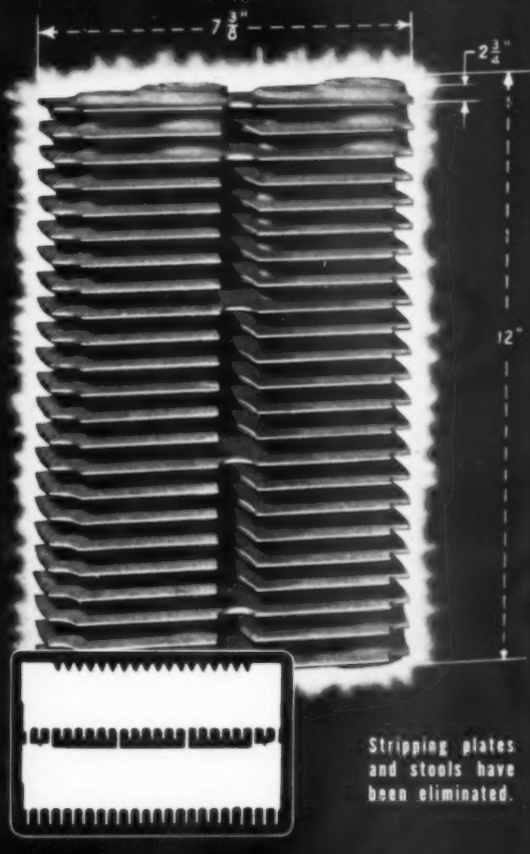
Old "Doc" Overhead "quizzes" a significant question: "What is a stripping plate?" Answer: "It is a device *no longer considered a necessary evil* in producing molds from 'mean' patterns which have a minimum amount of draft and deep pockets." "Correct!" pronounces "Doc" Overhead.

How much are stripping plates costing you? First you have to make them. Then you have to keep them in constant repair. You have to clean under them after completing each mold. If anything goes wrong, you often lose a whole day's production. You waste time and money—a lot of both.

All this, because the stripping mechanisms on molding machines have seldom been accurate, and you therefore had to call upon stripping plates to aid in lifting out deep pockets and tough pattern draws with very little draft.

That is, *you thought you did.* But you don't now—NOT ANY MORE. Look at this exceedingly "mean" radiator casting with its 22 deep ribs close together and a whole flock of deep pockets to draw out. It is made on a SPO No. 200 Series Pin Lift Machine. The patterns are mounted on plain flat plates. *And stripping plates and bolsters, with all their annoying and expensive drawbacks, have been eliminated.*

"How come?" you may ask. Well, chiefly because these SPO Jolt Squeeze Strip Machines have a patented self-aligning feature which insures a perfect draw and perfect stripping—*every time.* Conservatively, your output should jump about 15%. More than that, the money you have been spending for making and maintaining a few sets of stripping plates will put a swell new SPO unit on your floor without investing one cent additional.



Stripping plates and stools have been eliminated.

SPO designs and builds both molding machines and pattern equipment, and guarantees them unconditionally to produce castings which will be in accordance with your specifications.

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(*Concluded from page 76*)

gearing is shifted through first, second, third and into fourth or direct drive. Olds is offering the drive for only $57 on three series of models, and it is expected that eventually it will be available on all General Motors cars. In fact, a transmission division, recently set up in Detroit, now is equipped to turn out the device in volume quantities. However, for the first year it will be limited to use on the Olds.

New type of tappet introduced on 1940 Chevrolet engines is a combination of a chilled iron casting brazed to a small screw machine piece of steel at the top, on which the pushrod rides. Former tappet was a hollow casting with a chilled face riding on the camshaft and the pushrod extending down through the tappet and seating on the inside of the lower face. In the new design, the cast iron body with chilled face is retained but at the top is a so-called "flower pot" or cupped piece of steel which is copper brazed to the cast iron and the surface of the cup hardened by induction heating and quenching. Pushrod rides in the cup and thus can be made about 2 inches shorter.

Hydrogen furnace is used for the brazing operation, and special equipment has been developed for induction hardening the tip. The latter comprises two large wheels, each with 36 holes in their outer edge which carry the tappets between inductor blocks and quench, indexing one station every 1.2 seconds.

Pearlitic malleable iron rocker arm pads for Buick engines, formerly hardened in a lead pot, likewise now are being hardened by the induction method on a special machine developed for the purpose. The rocker arms are placed in nonmetallic fixtures attached to micarta cross bars fastened to horizontal stainless steel chains. They travel across the top of the machine and the rocker arm pads pass between inductor blocks which heat them electrically to the desired temperature and an instant later a quench spray cools them. Hardness of rockwell 58 is obtained on the surface of the pads, at a production rate of 1800 per hour.

Firm Honors 38 Old Time Employes

At a dinner and celebration at the Pfister hotel, Milwaukee, Sept. 23, the Allis-Chalmers Manufacturing Co., honored 38 veteran employes who have been connected with the company in various capacities for 50 years or more. Each man was presented with a gold watch suitably engraved and with a copy of a new booklet in gold, gray blue and black, with a picture and brief biography of each man. The dedication, headed "We've Gone Places Together" and signed by Gen. Otto H. Falk, board chairman, Max W. Babb, president and William Watson, vice president in charge of manufacturing, states: "When you started your work with us 50 years ago we were a small company. Today, with your help, Allis-Chalmers has become a great name. Its achievements are your's . . . . for you, yourselves are the men who have had a hand not only in building the machines that have made Allis-Chalmers famous, but actually in forming the character of the great company itself!"

Nine of the 38 men are foundrymen as shown in the following list presented alphabetically:

Joseph Freisinger continuously employed by the company since 1886. In 1921 he became foreman of the West Allis foundry and in 1938 was appointed advisory superintendent.

Joseph Furlong started in 1888 and has served in the foundry, cost, accounting, estimating and sales. He is now assistant manager in charge of mining machinery division.

George Geiger began work as a molder at the Reliance plant in 1886. He has been in the West Allis plant since 1915.

A. E. Harrison's record goes back 58 years to Feb., 1881 when he started to work for the E. P. Allis Co. For many years he was general superintendent of foundry and pattern shop. Four generations of the family have worked for the company. He now resides in Florida.

Robert Henderson began his long career of 53 years at the old Reliance plant as a time keeper. Later he went to the South foundry and from there into the cost department.

George Klenk started in at the opening of the brass foundry Aug., 1888 in the old Reliance works. He was appointed foreman in 1908.

Eugene Kuney, Sr., started as a molder in 1883 and became foreman in 1921. As a boy in France he worked on castings for the Eiffel tower and the statue of Liberty, well known land mark in New York harbor.

John Leisk present general superintendent began as a molder 50 years ago in the old Reliance works. At West Allis in 1906 he was appointed foreman and became superintendent in 1924.

John J. Ryan started in the shipping room in 1882. In 1899 he became clerk in the South foundry. In 1906 he became superintendent clerk in the foundry office West Allis works.

Packard foundry currently is melting about 200 tons of iron per day on one shift, operating two cupolas. Another may be added about Nov. 1. The operator here is pouring cylinder block molds, filling three molds with one ladle of iron. Smaller molds on the line at the left are rear axle housings, two to a mold and two molds to a car

American Refractories institute, Pittsburgh, has published an information circular entitled "Advantages in the Use of High Temperature Bonding Mortars," by J. A. Patterson, which describes briefly important properties of high temperature bonding mortar, and indicates the increased service that can be expected from refractory brick laid with it.

ABSTRACTS . . . . . .

FROM WORLD FOUNDRY LITERATURE

Sand Preparation

Preparation of Sand, anonymous, *The Engineer and Foundryman*, Johannesburg, South Africa, August, 1939.

A brief resume of the principles of sand preparation to insure better castings production, this article discusses various phases such as screening, magnetic separation, dust extraction, disintegration or aeration, etc. Illustrations show various types of machines employed.

Alloying Iron

The Mixing of Alloy Cast Iron (Die Gattierung legierter Gusseisen), by H. Uhlitzsch, and K. Appel, *Die Giesserei*, Duesseldorf, Germany, May 31 and June 16, 1939.

Beginning with a general discussion of alloying elements chromium, nickel and molybdenum, the authors cover various phases relating to their addition to cast iron, and end with development of curves to indicate the proper combination of alloy, total carbon content, and silicon content for a given section thickness. These phases include production of test melts and test bars, cast iron diagrams, diameter, development of cast iron diagrams for nickel, molybdenum and chrorelation of wall thickness to test piece mium, concept of the increment of Si as the difference in silicon content in unalloyed and alloyed iron with the same carbon content and test piece diameter, comparison of the increment of Si value for each 0.5 per cent alloy addition, development of graphs or curves for proper combination of alloy, carbon and silicon content, etc.

Centrifugal Casting

Developments in Centrifugal Casting, by W. A. Geisler, *The Metal Industry*, London, England, Aug. 11, 1939.

This article is concerned with the centrifugal casting of nonferrous metals as practiced in Germany, and gives a detailed description of various methods employed at a number of plants. Information is presented on the procedure used in making nonferrous pipes and tubes, blast furnace tuyeres, hollow cylinders with inner flanges, billets and bars, and casting and lining of bearings.

Selecting Bronze

Selecting Bronze for Castings, by C. H. S. Tupholme, *Canadian Metals and Metallurgical Industries*, September, 1939.

Stating that for the engineer there is practically no difference in appearance, either in the rough or machined condition, between a sound bronze casting and one having a microstructure and physical properties quite unsuitable for the service required, the author goes on to say that drawing up a specification for bronze to meet a specific service requires more than a superficial knowledge of the factors which go to the making of a satisfactory bronze casting. He follows with a discussion of the effect of alloying elements, centrifugal casting, choice of raw materials, and melting practice. His preference is for pure or virgin raw materials since in his opinion the small increase in cost is justified amply by the resulting quality of the casting.

Aluminum Alloys

Nonferrous Foundry Practice—XXVII The Aluminum Alloys (Concluded), by J. Laing and R. T. Rolfe, *The Metal Industry*, London, England, July 28, 1939.

This is the twenty-seventh in a series on nonferrous foundry practice, and the sixth and concluding installment relating to aluminum alloys. It presents a discussion of alloys containing magnesium silicide, constitution and heat treatment of magnesium silicide alloys, and then gives information on molding technique, such as ramming, venting, gating, risers, and chills. The authors point out that ramming should be light and uniform, and that venting ordinarily is not required. Gates must be positioned to permit metal flow into the cavity without agitation, and plenty of risers of sufficient size to insure a good liquid feed are required. Pouring temperatures range from 675 to 780 degrees Cent. for most alloys. Silicon-aluminum (13 per cent) are modified at 760 degrees Cent. with sodium or sodium salts, and poured at 700 to 725 degrees Cent.

Magnesium Alloys

Magnesium Alloys, Their Importance as Engineering Materials, by Martin Phillipp, *The Metal Industry*, London, England, May 26, 1939.

Metallic magnesium is being produced on a large scale in Germany, and during the past decade has attained an important position. In this article the author discusses properties of magnesium and its alloys, and describes their application. Data are given on compositions and physical properties of the various alloys in common use.

Steel Castings

Chrome Steel Castings, (Chromstahlguss), by K. Roesch, *Die Giesserei*, Duesseldorf, Germany, July 14, 1939.

While about 10 years ago it appeared as though steel castings were being replaced by welded and forged construction, that is not true today since development or improvement of steel castings has won back much ground and limited the substitution of welded construction. Improvements advancing steel castings according to the author are use of the electric furnace making easier production of high quality castings, repetitive manufacture providing lower costs, steel castings give greater safety than welded construction for dynamic loading, heat treatment making possible the highest mechanical properties, use of alloy steels for highest stresses, and application of alloy steels particularly high alloy chromium steels in place of restricted materials such as bronze.

The author then goes on to discuss properties of chromium steels containing from 1 to 16 per cent chromium, concluding that those with 1 to 2 per cent possess high physical properties and hence permit use of lighter sections and lower weights. With a chromium content upward of 6 per cent the steels are heat resisting, and with from 12 to 16 per cent chromium and low carbon content the steels are stainless or rust resisting. The latter are replacing bronze since they also have high strength and resist wear.

Copper Base Alloys

Cast Copper and Copper-base Alloys—Their Nomenclature and Classification, by Sam Tour, *The Metal Industry*, July 21, 1939.

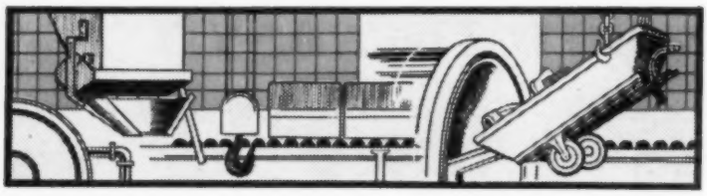
The author points out that while numerous suggestions have been made for a classification system for copper and copper alloys, no suitable system was developed due to the wide variety of metals and alloys involved, and to the names under which they were designated commonly. He then discusses the terms brass, tin bronze and other bronzes as to compositions, etc. In conclusion the author offers a classification system for copper-base alloys which has 3 main headings of copper, brass and bronze. Essentially copper is limited to not over 2 per cent of other elements; brasses have numerous subdivisions, the zinc content being greater than the tin; bronzes like brasses are numerous with tin content greater than zinc. Bronze classification also includes aluminum, silicon and beryllium bronzes.

Gases and Oxides

Relationship Between the Quality of Iron and Steel Castings and the Nature of the Raw Materials (Zusammenhang zwischen der Guete des Eisens—und Stahlgusses und der Beschaffenheit der Schmelzstoffe), by P. Bardenheuer, *Die Giesserei*, Duesseldorf, Germany, Aug. 11, 1939.

Most important considerations for the production of nondefective iron and steel castings according to the author are use of good raw materials as well as correct metallurgical melting practice. However, in spite of suitable chemical composition and good melting practice defective castings were obtained. Investigation showed that these resulted from gases and oxides in the metal. The gases are present partly in the materials composing the melt or absorbed partly during melting. Hydrogen is one of the most important since if liberated in the mold during solidification it forms blowholes while if liberated by reduced solubility in the freezing metal it collects in a molecular state at the grain boundaries and at nonmetallic inclusions under high pressure producing stresses in the casting. The author then discusses various melting processes to show how gases may be incorporated and the importance of degasification.

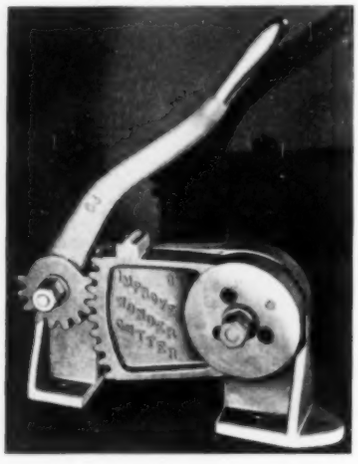
NEW EQUIPMENT . . .



AND SUPPLIES

Wire Cutter

Federal Foundry Supply Co., 4625 East Seventy-first street, Cleveland, has developed what is claimed to be an extremely efficient, and simplified wire and rod cutter as shown in the accompanying illustration. The machine will cut rods and wires up to and including rods ⅝ inch diameter. Three simple castings that make up the body of the cutter have been strengthened with consequent improvement in the operation of the machine. Cutter dies are hardened die steel. Small size of the unit permits setting up in any convenient place where it will not be in the way. Overall dimensions are 4 x 8 x 15 inches and total weight is 36 pounds.

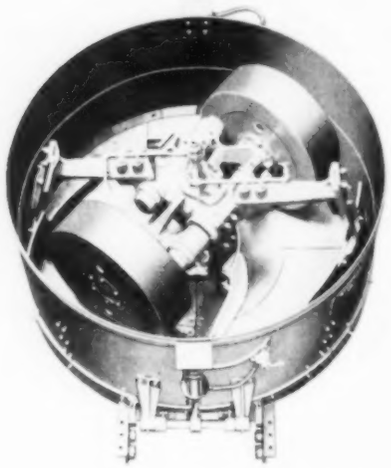


Goggles

Mines Safety Appliance Co., Braddock, Thomas and Meade streets, Pittsburgh, recently has developed a speedframe consisting of suitable goggles mounted in a light weight, comfortable, fiber head frame, so designed that a simple nod of the head positions the goggles in front of the eyes, while another nod will throw them up and out of the way. The goggles, it is claimed, remain in either position without further adjustment, giving uninterrupted use of both hands. It is stated the assembly is adjustable and holds the goggles when lowered, properly and comfortably in place.

Sand Mixer

National Engineering Co., 549 West Washington boulevard, Chicago, recently installed two large sand mixers in a prominent agricultural implement foundry. Each of the mixers, one of which is shown in the accompanying illustration is 9 feet 3 inches in diameter and weighs approximately 35,000 pounds. They are equipped throughout, with antifriction bearings and each of the mullers weighs 5500 pounds. It is claimed that a batch of 5000 pounds of sand is prepared for use in approximately 2 minutes. Each mixer is built with an integral drive mounted on the bed plate and attached through a flexible coupling to a 60 horsepower motor. These machines are made in a wide variety of sizes including one 8 feet in diameter capable of preparing a batch of 3000 pounds of molding or core sand in 2 minutes.

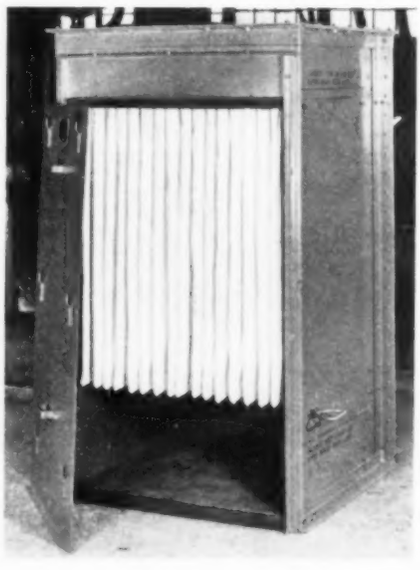


Dust Filter

W. W. Sly Mfg. Co., 4700 Train avenue, Cleveland, has developed a new compact dust filter which may be placed close to individual machines needing exhausting, or used as auxiliary equipment for all types of dust conditions in connection with large dust filters. The flat cloth bag, shown in the accompanying illustration, cleans the dust laden air. The bags are shaken out by hand with the handle shown at the right, to remove clinging dirt.

The unit is supplied in four sizes with a net cloth filtering area ranging from 88 square feet to 352 square feet, handling air in volume

(*Concluded on page* 84)



MACKLIN
Grinding Wheels

MACKLIN Grinding Wheels are giving excellent results on floor stands and all types of foundry grinding requirements. Macklin's clean, cool, fast cutting action will "Protect Your Production" and cut grinding costs.

Ask for the experienced suggestions of a Macklin Sales Engineer, who will, without obligation, help you work out any grinding problem.

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS—JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

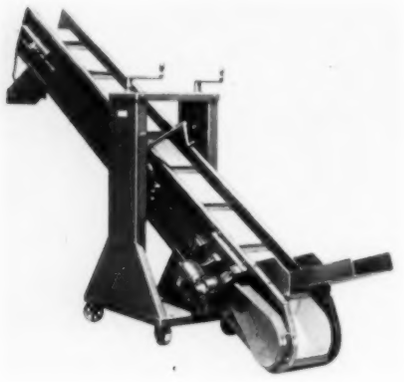
***Sales Offices:*—Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia**

(*Concluded from page 82*)

from 350 cubic feet per minute and under, up to 1500 cubic feet per minute. The filter can be used on the floor, mounted against the wall, or suspended from overhead.

Work Loader

Mechanical Handling Systems, Inc., Nancy avenue, Detroit, recently has placed on the market a portable belt type work loader, shown in the accompanying illustration and adjustable for height and angle of incline to meet local conditions. It is claimed to offer a solution for the problem of handling a multiplicity of small parts through successive operations. The device, known as an eleveyor, consists of a cleated endless belt conveyor assembly approximately 9 feet in length mounted on a caster equipped stand. Driven by a ¼-horsepower, single phase 60 cycle motor mounted on the side of the frame, the usual speed of the 12-inch belt is 60 feet per minute. An adjustable loading chute feeds the parts on to the belt provided with cleats 18 inches apart. A flapper gate holds the parts until a cleat comes into position. An adjustable delivery chute suspended from the discharge end of the frame delivers the parts at required working height or into a portable bin. A wire mesh belt is available where a hot product is handled.



Rubber Mold

Alrose Chemical Co., Providence, R. I., announces the development of a complete, low cost process for producing white metal castings in rubber molds. It is claimed that quality castings of fine detail and smooth texture can be produced without blow holes, on a production basis. With the new process it is stated from 2000 to 14,000 castings can be produced from a mold costing less than $5.00. Other claims are that models may be of any metal and require no draft. Undercut items may be produced readily. Any item may be duplicated in the space of a few hours, an important factor in filling rush orders. A large sample range can be produced at low cost. From 1 to 72 pieces may be cast simultaneously in one mold, depending on size. The entire process can be set up and operated in a space 60 x 60 inches. The process is particularly applicable to the production of toys, novelties, etc.

Portable Grinder

Stow Mfg. Co., Inc., Binghamton, N. Y., recently has placed on the market a small size multispeed flexible shaft machine, as shown in the accompanying illustration, and designed for grinding, drilling, polishing, wire scratch brushing and other similar operations. The motor with extension cord and plug for any light socket is mounted on a four caster base. It is equipped with an adjustable arm for regulating belt tension, a three step cone pulley, a V-belt and a flexible shaft with clamp spindle. Designed on the principle of the company's heavy duty machine, the shaft consists of a rugged over size flexible core with an oil resistant rubber casing. The motor end of the shaft is reinforced and is fitted with oil tight bearings. The hand piece is fitted with precision ball bearings with labyrinth oil seal and has a removable clamp spindle. The new model is offered with either a ¼ or 1/3-horsepower motor and a speed range from 875 to 3500 revolutions per minute. Shaft sizes are ⅜-inch x 5 feet for the ¼-horsepower unit and 12-inch x 6 feet for the 1/3-horsepower unit with a maximum wheel capacity of 1 x 6 inches and a drill capacity up to ⅜-inch.

Brinell Machine

Detroit Testing Machine Co., Detroit, recently has placed on the market a new type brinell testing machine, as shown in the accompanying illustration, for handling large, awkward castings, forgings, etc. The new machine has a large stationary table and a ram sufficiently long to cover a wide range of sizes. The part to be tested is placed on the table where the ram carrying the test ball is brought into contact with it. Operation is controlled by a lever on the side of the machine and the ram may be stopped at any position. Where several pieces of the same size are to be tested the ram is raised only enough to remove and insert the pieces.

Movement of the lever rapidly adjusts the ram for pieces of different sizes. While the ram movement is rapid the actual test is applied at a relatively low speed thus avoiding impact error. Operation is hydraulic throughout. A fractional horsepower ball bearing motor drives the pump in which the shaft also is mounted in ball bearings. All working parts are bathed in oil to insure long life and minimum of maintenance. The machine is available in two standard sizes. One has a throat depth of 6 inches, maximum height 12 inches, table 12 x 20 inches. The other has a throat depth of 9 inches, maximum height 18 inches, table 17 x 24 inches. The company is prepared to build machines to any special dimensions.

THIS TABOR ABRASIVE CUT-OFF MACHINE

"Paid for Itself"

IN LESS THAN

3 MONTHS!

COMMERCE PATTERN FOUNDRY & MACHINE COMPANY

MALLORY METAL 3

TOOLS AND DIES - SPECIAL MACHINE WORK
BRASS, BRONZE, ALUMINUM AND HY-CON COPPER CASTINGS
WOOD AND METAL PATTERNS
2211 GRAND RIVER AVENUE
DETROIT

AMPCO METAL

The Tabor Manufacturing Co.
6225 Tacony Street
Philadelphia, Pennsylvania

November 14, 1938

Gentlemen:

Below is a brief outline of our experience with this machine. Before we had the Tabor machine for cutting off castings, it was necessary for us to have at least four to six men to cut off castings with hack saws and band saws. Since the purchase of this machine, the cost has been cut considerably because one man is all that is necessary. ☆☆ It has also saved us considerable grinding, as we can now cut the gates and risers off of the castings so close no grinding is required. ☆☆ We have found that this machine has paid for itself in less than three months. ☆☆ We have also made comparative tests of this machine against band saw machines, taking a coupon 4" x 4" x 10". We find that the cutting off by the band saw requires three band saws and takes forty-five minutes but, with the Tabor machine, cutting off same sized coupon, the time required is only five minutes.

Very truly yours
COMMERCE PATTERN FOUNDRY & MACHINE COMPANY
L. J. Rousseau Pres
Secretary

LJRousseau:DG

Made by the manufacturers of

TABOR
TRADE 1884 MARK

FOUNDRY
MOLDING MACHINES
and
FOUNDRY
EQUIPMENT

That puts it up to you . . . can you afford to be without such a profit producer?

TABOR
TRADE 1884 MARK

MANUFACTURING COMPANY
6225 Tacony Street, Philadelphia, Pa.

Foreign Representatives:

Australia and New Zealand: Norman N. Benson, 532 Kent St., Sydney, Aus.

KNOWLEDGE IS DANGEROUS

(*Continued from page* 35)

blow may be, and sometimes is, cooled by additions of steel scrap during this same stage of the process.

In this period of the blow, three of Sim's recommended methods of securing low gas content in acid electric furnace steel—to secure which great care is taken by modern furnace operators—quite evidently occur of their own accord in the converter. These are (1) long vigorous boil, (2) thorough oxidation, (3) low residual silicon and manganese, which of course are almost automatically secured. That these three conditions do not necessarily give gas-free steel is shown by the undoubted fact that though side blown converter steel does not suffer greatly from gas troubles, metal made in small bottom blown converters commonly does. Perhaps because the air is blown through rather than over the steel, so that more opportunity is given for the absorption of nitrogen from the air and hydrogen from the water vapor necessarily present in the blast, it is a proven fact that it is far more difficult to prevent absorption of gas and consequent formation of pin holes during solidification of steel made in a small bottom blown converter than in side blow metal. Possibly, too, the trouble in part may be due to more rapid oxidation and rise of temperature in the bottom blown converter, which often results in oxidation of carbon before silicon and manganese are reduced to a low enough figure to give the most desirable conditions of iron oxidation. In any event, in the light of these facts, boiling alone is not a complete answer.

Similarity to the recommendations for making good acid electric furnace steel are striking. To melt high in carbon and boil vigorously till the carbon, silicon and manganese are reduced to about 0.06 to 0.10 per cent, is a *sine qua non* of converter operation and occurs automatically, demanding only that the blow be stopped at the drop of the flame.

(*Concluded on page* 89)

Table IV

Chemical and Physical Properties of Converter Steel

Made by the Converter Process at the Plant of the Link-Belt Co., Chicago. For QQS 681 a. Normalized and Drawn

Date	Blow	C.	Si.	M.	S.	P.	T. S.	Y. P.	Ext.	R. A.	Bend
6/22/37	10	0.28	0.42	0.61	0.036	0.027	81500	48000	27	43.4	OK
							81500	47750	28½		
6/23/37	11	0.26	0.40	0.70	0.024	0.029	74700	43400	32½	53.1	OK
							76650	43300	30½	52.8	
6/24/37	12	0.30	0.38	0.72	0.026	0.031	83500	46250	27	44.9	OK
							83650	48500	26	45.5	
6/25/37	13	0.27	0.33	0.66	0.027	0.028	72600	40250	33	59.4	OK
							73000	44250	30	46.3	
6/28/37	14	0.28	0.40	0.72	0.026	0.029	73250	40750	32	54.4	OK
							73250	45000	30½	47.2	
6/29/37	15	*0.24	0.40	0.67	0.033	0.029	71500	41250	30	47.5	OK
							73200	42500	33	57.0	
6/30/37	16	*0.27	0.36	0.80	0.031	0.037	78000	47000	27½	42.5	OK
7/1/37	17	*0.28	0.44	0.80	0.031	0.036	78800	48000	27½	44.0	OK
							83500	53500	26½	39.4	OK
7/2/37	18	*0.25	0.36	0.65	0.038	0.020	86900	47250	27½	39.1	
							75500	42750	30	48.9	OK
7/8/37	19	0.28	0.36	0.70	0.026	0.031	76600	45750	30½	52.8	
							76000	49500	32	32.8	OK
7/9/37	20	0.26	0.40	0.73	0.023	0.032	76750	42500	31	55.5	
							76750	43000	30½	49.5	OK
7/12/37	21	0.27	0.38	0.60	0.027	0.023	74500	42000	33½	58.3	
							76250	46250	27½	38.2	OK
7/13/37	22	0.27	0.37	0.73	0.022	0.027	75700	45900	26½	38.2	
							80500	43500	31	57.0	OK
7/14/37	23	0.26	0.36	0.72	....	0.039	79700	44700	30½	57.3	
							76500	45000	32	56.0	OK
7/15/37	24	0.30	0.32	0.76	0.021	0.030	75750	45700	32½	58.3	
							80500	44000	29½	46.3	OK
7/16/25	25	0.26	0.37	0.73	0.020	0.033	82800	45500	25½	36.8	
7/19/37	26	0.29	0.42	0.85	0.024	0.039	80500	43000	29½	54.1	OK
							84500	49500	30	51.9	OK
12/16/27		0.27	0.36	0.70	0.033	0.04	88260	49500	27	51.7	
							74500	41500	32½	53.3	

*Not drawn.

(For Specification QQB681, Class 2)

10/14/36	C1	0.33	0.42	1.06	0.038	0.035	81600	43000	27	38.3	OK
							82000	43500	27	44	OK
10/15/36	D1	0.32	0.47	0.81	0.028	0.032	73250	41000	33	49.2	OK
							73400	40800	31½	49.2	
10/16/36	E1	0.36	0.49	1.02	0.027	0.033	86000	45000	23½	34.4	OK
							87000	45250	27½	41.6	
10/19/36	F1	0.30	0.42	0.76	0.028	0.039	81000	42500	25	31.5	OK
							80500	42000	25	30.2	
10/20/36	G1	0.32	0.45	1.08	0.028	0.031	83250	44000	25	37.3	OK
							82750	32200	27	40.1	
10/21/36	H1	0.31	0.40	0.76	0.032	0.033	83000	50000	23	31.5	OK
							87000	45250	27½	41.6	
10/22/36	I1	0.26	0.42	0.68	0.027	0.035	75500	43500	26½	32.1	OK
							74850	41000	28½	37.6	
10/22/36	J1	0.27	0.40	0.68	0.027	0.032	75250	40750	27	35	OK
							75550	39750	30	38.8	
10/23/36	K1	0.30	0.49	0.74	0.027	0.030	76750	43150	24½	37.0	OK
							77000	43250	24	33.1	
10/23/36	L1	0.30	0.43	0.87	0.033	0.030	83500	53000	24½	33.8	OK
							82000	47800	22½	31.5	
10/26/36	N1	0.27	0.33	0.74	0.030	0.029	72850	42150	23	41.3	OK
							73250	42000	25½	34.7	

(*Concluded from page 86*)

Building of a highly siliceous slag by oxidation of silicon and absorption from the converter lining, also occurs automatically, as in acid electric furnace practice when no sand is added.

The other three of Sims 1932 requirements for low gas content also occur automatically in converter practice: (4) moderate metal temperature, (5) no increase of temperature after deoxidation, and (6) deoxidation late in the heat. Since the blow and the production of heat necessarily are over before converter steel can be deoxidized, requirements 5 and 6 are automatic. Competent observers will agree that in the converter moderate metal temperatures are more often not exceeded than in the electric furnace where a few minutes inattention may result in a great increase of temperature.

Add the Ferroalloys

When the converter is turned down, ferrosilicon is charged to the bath for deoxidation, usually by wetting the lumps and throwing them into the mouth of the vessel. The explosive evaporation of the water on the lumps pushes aside the blanket of slag and allows the additions to enter the bath without being trapped in the slag. Ferromanganese usually is added in the same manner. To bring the carbon to the desired point liquid pig iron from the cupola is poured into the mouth of the vessel from a hand shank. The converter then is rocked back and forth a few times to assist diffusion of metalloids in the additions.

Sims' 1932 recommendations for promoting the retention of gases in solution during solidification, (1) thorough deoxidation, and (2) minimum exposure after deoxidation, thus either automatically are carried out or easily secured. There may be some question whether the ferrosilicon and ferromanganese have equal opportunity to deoxidize the steel in the converter as in the electric furnace, where the temperature of the metal can be kept up by the electric current, but the difference in favor of the furnace is slight. In the case of the pig iron additions, the advantage is slightly in favor of the converter, where that material almost invariably is added molten and quite hot, and hence diffuses rapidly. Where the ferrosilicon and ferromanganese also are premelted, the rapidity with which they work is also greater in the converter.

Conditions for good acid electric furnace steel making outlined in Sims' 1937 paper and its discussion are closely paralleled in the converter, with the further advantage that harmful increase of temperature after deoxidation and undue exposure after deoxidation (at least in the vessel) are impossible, and unduly high metal temperatures are not often encountered.

Not Afraid of Aluminum

The next precaution advocated in the 1937 recommendations, addition to the ladle of enough aluminum to completely deoxidize the metal and leave a considerable excess, was carried out in converter practice for many years, though not as much aluminum usually was added as is now recommended for acid electric furnace steel. Converter operators never have been as afraid of additions of aluminum as were the electric furnace men. Apparently the latter so often had had open hearth experience where aluminum usually was not required, and even quite often was regarded as *poison*, that they disliked the use of aluminum and tried to keep it to the very minimum amount required to prevent the formation of pinholes. Even electric furnace operators without open hearth experience appear to have followed the same idea. As now pointed out in the researches described, these small additions of aluminum, just enough to reduce all the iron oxide and very little over, are precisely the thing to bring about low ductility. We who operated converters, on the other hand, probably from the idea that converter metal necessarily is heavily oxidized and therefore requires large doses of deoxidizers, always gave our metal a liberal dose of aluminum, like the old women who use the well-known vegetable (and alcohol) compound, and take "a good swaller" whenever they feel the need of stimulation. The aluminum commonly was tossed into the stream as soon as the bottom of the ladle was covered with steel. This parallels the practice in some of the electric furnace shops reporting on the use of the Sims' technique in 1937.

Figures recently secured for converter practice in one of the best shops in the country, in 1923, 1925, and 1932, show an average of 0.038, 0.06 and 0.043 per cent aluminum used per ton of steel in the ladle. In another shop of which I had personal knowledge, the practice for many years was to add from ¾-pound (0.038 per cent) to 1¼ pounds (0.063 per cent) per ton, which tallies closely with the figures for the other shop. Sims' charts for well oxidized induction furnace steel of 0.06 per cent sulphur (about the amount present in the steel described) indicate that about 0.04 per cent aluminum is needed to restore the ductility of that grade of steel, but more is required in arc furnace practice. It seems remarkable that the converter metal should not require as much aluminum as the acid electric furnace steel. No doubt differences in degree of oxidation during manufacture, composition of slag at the time of the aluminum addition, temperature differences, and other variables, produce this result.

In any event, that castings free from pinholes were and are usually secured from converter steel is common knowledge. Comparative absence of aluminum embrittlement is testified to by the tabulations of physical properties shown in Tables I, II, III and IV. Truly it may be said of those who so unreservedly criticized the quality of converter steel, "A little knowledge is a dangerous thing."

This is the third and concluding article of a series prepared by the author on converter steel. Previous articles appeared in the September and October issues.

Make Ferroalloy

Sloss-Sheffield Steel & Iron Co., Birmingham, recently began operation in the manufacture of high grade ferromanganese. The furnace devoted to that product has an annual capacity of 30,000 tons, approximately the amount imported by the United States.

Ferromanganese to be manufactured by the Sloss-Sheffield company will be from manganese ores shipped from Cuban deposits. Improved processes for beneficiating the low grade deposits recently have been developed and the relatively safe sea lane from Cuba to Mobile permits the new endeavor to contribute to the self-sufficiency of the American steel industry.

American Management association, 330 West Forty-second street, New York, is publishing a series of pamphlets dealing with various problems facing industry. The following, recently published, may be secured at the prices indicated: "A Symposium on Unit Costs," $1.00; "Quality and Inventory Control," 75 cents; "Public and Industrial Relations in Production," 75 cents. Each pamphlet represents a symposium in which leaders in the particular phase under discussion contribute experience connected directly with the subject.

FACTS IN FOUNDRY COSTING

(*Continued from page* 33)

rymen and cost men usually agree that the time actually spent in making cores for a specific job is the correct base for calculating both labor and overhead. However, some of them attempt to simplify the casting procedure at the expense of accuracy, by adding a uniform percentage to the direct labor cost to cover overhead. How does the use of the uniform percentage simplify the procedure when it takes approximately the same time to multiply the labor cost by the uniform percentage as it does to multiply the hours spent on the particular job by the cost per hour?

Companies operating their core department on a day work basis can combine the labor and overhead rates and make one calculation on hours instead of separate calculations for labor and overhead.

There is a method by which coremaking costs may be had by consideration of the time factor and the wage rate of the coremaker without any multiplication. That method is explained in an article, "Common Sense Cost Estimating," presented in the March, 1937, issue of THE FOUNDRY.

Molding Costs Vary

Table III, "Molding Cost" shows the variance in costs for each job by distributing overhead on the basis of direct labor and direct labor hours. These variances usually are more pronounced where premium or piece rate methods are employed, and similar to core making, increased earnings due to the method of wage payment to molders does not proportionately increase some of the overhead costs. Increased earnings due to piece work and premium methods of wage payments to molders do not cause a proportionate increase in most of the larger elements of overhead. Neither does the substitution of direct labor for direct labor hours, as a basis for overhead distribution, materially reduce the clerical effort in estimating or calculation of actual operation costs. This also is explained in the article previously mentioned.

Table IV shows variances in the cleaning cost figures of the several jobs under review caused by three different methods of calculation:

1. Chipping, grinding and brushing on a measured time basis and tumbling on the basis of weight.
2. Average cost per pound.
3. Per cent of direct molding labor.

By the measured time basis, (1), the actual time required to chip, grind or brush forms the basis for calculations of both labor and overhead, except where piece work or other incentive wage systems are used requiring the calculations of labor in that manner. The overhead applicable to chipping, grinding or brushing, being distributed, (in either method of wage payment), on the basis of direct labor hours. Labor and overhead applicable to tumbling are combined and distributed to

(*Concluded on page* 92)

Table IV

Cost of Cleaning Castings

Pat. No.	Weight	(1) MEASURED JOB BASIS Chip Time	Grind Labor	Brush O. H.	Tumble Weight	Tumble Cost	Total	Cost per pound	(2) Average cost per pound	(3) Per Cent of Direct Molding Cost Mold Labor	Clean Cost	Per Pound
1	60	3.0	1.50	2.10	60	.18	3.78	.0630	.0080	3.76	4.29	.0714
2	36	.6	.30	.42	36	.11	.83	.0231	.0080	.72	.82	.0228
3	40	.6	.30	.42	40	.12	.84	.0210	.0080	.72	.82	.0205
4	46	.6	.30	.42	46	.13	.85	.0185	.0080	.80	.91	.0200
5	1015	7.0	3.50	4.90	...	...	8.40	.0083	.0080	6.00	6.84	.0067
6	1488	12.0	6.00	8.40	...	...	14.40	.0100	.0080	3.78	4.31	.0029
7	228	5.0	2.50	3.50	...	...	6.00	.0219	.0080	7.20	8.21	.0360
8	197	.6	.30	.42	...	...	.72	.0037	.0080	1.70	1.93	.0098
9	730	3.0	1.50	2.10	...	...	3.60	.0050	.0080	4.35	4.96	.0068
10	528	6.0	3.00	4.20	528	1.58	8.78	.0166	.0080	4.29	4.89	.0093
11	190	1.8	.90	1.26	190	.57	2.73	.0144	.0080	6.40	7.30	.0384
12	730	3.0	1.50	2.10	...	...	3.60	.0050	.0080	3.71	4.23	.0057
13	32	1.0	.50	.70	32	.10	1.30	.0407	.0080	.33	.38	.0119
14	30	.2	.10	.14	30	.09	.33	.0110	.0080	1.13	1.29	.0430
15	329	.4	.20	.28	329	.99	1.47	.0045	.0080	4.88	5.52	.0137
16	1422	3.0	1.50	2.10	...	...	3.60	.0026	.0080	3.45	3.93	.0027
17	8	none	none	...	8	.02	.02	.0025	.0080	.33	.38	.0475
18	105	1.2	.60	.84	105	.32	1.76	.0168	.0080	1.96	2.23	.0212
19	875	3.0	1.50	2.10	...	...	3.60	.0041	.0080	1.68	1.65	.0048
20	49	.6	.30	.42	49	.15	.87	.0178	.0080	.33	.38	.0078
21	172	.4	.20	.28	172	.52	1.00	.0058	.0080	1.88	2.14	.0124
22	28	.6	.30	.42	28	.08	.80	.0287	.0080	.68	.78	.0280
23	11	.2	.10	.14	11	.03	.27	.0246	.0080	.15	.17	.0155
24	225	.8	.40	.56	225	.68	1.64	.0073	.0080	2.40	2.74	.0122
25	40	.4	.20	.28	40	.12	.60	.0150	.0080	.33	.38	.0095
26	1746	4.4	2.20	3.08	1746	5.27	10.55	.0060	.0080	4.20	4.79	.0028
27	90	.4	.20	.28	90	.27	.75	.0083	.0080	.83	.95	.0105
28	48	.4	.20	.28	48	.14	.62	.0130	.0080	1.95	2.22	.0462
29	280	1.0	.50	.70	280	.87	2.07	.0072	.0080	2.81	3.20	.0110
30	34	.2	.10	.14	34	.10	.34	.0100	.0080	.17	.19	.0056
31	6	.2	.10	.14	6	.02	.26	.0433	.0080	.26	.30	.0500
32	26	none	none	...	26	.08	.08	.0031	.0080	.17	.19	.0071
33	2	none	none	...	2	.01	.01	.0050	.0080	.09	.10	.0500
34	6	.2	.10	.14	6	.02	.26	.0433	.0080	.17	.19	.0317
35	27	.2	.10	.14	27	.08	.32	.0119	.0080	.17	.19	.0070
36	18	none	none	...	18	.05	.05	.0028	.0080	.26	.30	.0166
	10907	62.0	31.00	43.40	4222	12.70	87.10	.0080	.0080	76.41	87.10	.0080
Chip—Grind—Brush		Direct Labor					31.00	.....	.....	....	31.00	.....
		—Overhead					43.40	.....	.....	....	43.40	.....
Tumble		—Labor				5.50	5.50	.....	.....	....	5.50	.....
		—Overhead				7.20	7.20	.....	.....	....	7.20	.....
Total						12.70	87.10	.....	.....	....	87.10	.....

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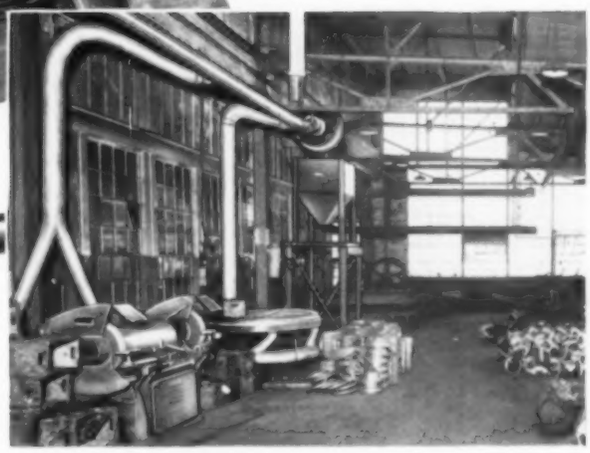

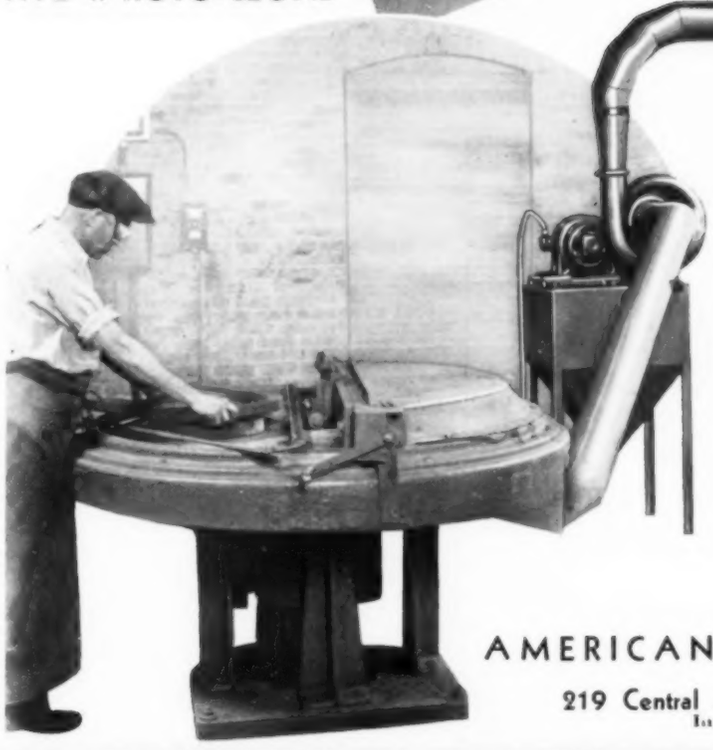

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FOR FOUNDRY AAF DUST CONTROL

(*Concluded from page* 90)

jobs on the basis of the weights of jobs tumbled.

The averaged cost per pound method, (2), distributes the total cleaning and shipping labor and overhead to the several jobs in ratio of weight of each job to the total weight cleaned. Unreliability of that method can be determined quickly by comparing the cost per pound of the several patterns with the measured cost per pound shown in section one of Table IV.

The percentage of direct molding labor method, (3), distributes the combined cleaning labor and overhead in ratio of the direct labor cost of each job to the total direct labor of all jobs. This method presumes that there is a direct relation between the earnings of the molder and the time actually required to clean each job. Comparison of the costs of the several patterns figured on this basis with the measured costs shown in section one of Table IV is proof that there is no consistent relation between the earnings of the molder and the time actually required to clean each job. Both the average cost per pound and the percent of direct molding labor methods of calculating cleaning costs are so susceptible to erroneous results that sensible price making is not possible.

Table V shows the conversion or production costs per pound of the several jobs calculated by combining core making, molding, overhead and cleaning costs in one amount and distributing that amount to the several jobs on the basis of direct molding labor. That method presumes that there is a prevailing relationship between molding labor and all other conversion or production costs.

Should Not Be Used

That system of costing is rarely used, and a comparison of job costs obtained by the method with the costs of the same jobs calculated by actual measured facts should convince those foundries using it that the results secured are of no practical use and should be discontinued.

Data in the tables compiled from actual performance shows that the use of averages of unrelated cost facts do not give the same answer as is obtained by measuring the individual costs of the several operations performed.

But some foundryman will say, "My foundry is different, I do no jobbing work only castings for my machine shop." The fact that the castings are used in the company's own departments in further fabrication does not alter the foundry operations necessary to produce the rough castings. Therefore the system of costing should be as accurate and dependable as if the castings were sold to some other company for fabrication.

Foundrymen would do well to apply the methods shown herein to their own jobs before deciding on the practical one to use in estimating jobs for quotations.

Table V

Cost of Conversion

Coremaking and Cleaning Included in Molding Overhead

Pat. No.	MEASURED COST Core	Mold	Clean	Total	Per Pound	Weight	AVERAGED COST Mold Labor	O. H.	Total	Per Pound
1	3.81	8.46	3.78	16.05	.267	60	3.76	13.14	16.90	.280
2	....	1.62	.83	2.45	.068	36	.72	2.52	3.24	.090
3	....	1.62	.84	2.46	.061	40	.72	2.52	3.24	.080
4	1.37	1.80	.85	4.02	.087	46	.80	2.80	3.60	.078
5	9.60	13.50	8.40	31.50	.031	1,015	6.00	21.05	27.05	.027
6	10.92	7.98	14.40	33.30	.022	1,488	3.78	13.21	16.99	.011
7	4.06	15.20	6.00	25.26	.110	228	7.20	25.18	32.38	.142
8	1.71	3.70	.72	6.13	.031	197	1.70	5.94	7.64	.039
9	11.20	10.15	3.60	24.95	.034	730	4.35	15.21	19.56	.027
10	....	10.89	8.78	19.67	.037	528	4.29	15.00	19.29	.036
11	3.43	14.40	2.73	20.56	.109	190	6.40	22.37	28.77	.152
12	1.52	9.41	3.60	14.53	.020	730	3.71	12.97	16.68	.023
13	.40	.83	1.30	2.53	.079	32	.33	1.15	1.48	.046
14	....	2.63	.33	2.96	.100	30	1.13	3.95	5.08	.169
15	4.84	11.38	1.47	17.69	.054	329	4.88	17.06	21.94	.068
16	.40	8.75	3.60	12.75	.009	1,422	3.45	12.06	15.51	.011
17	....	.83	.02	.85	.106	8	.33	1.15	1.48	.185
18	1.56	6.86	1.76	10.18	.099	105	1.96	6.85	8.81	.084
19	1.17	9.18	3.60	13.95	.016	875	4.08	14.27	18.35	.021
20	1.90	.83	.87	3.60	.073	49	.33	1.15	1.48	.031
21	4.18	4.38	1.00	9.56	.056	172	1.88	6.57	8.45	.049
22	1.00	1.58	.80	3.38	.120	28	.68	2.38	3.06	.110
23	1.00	.35	.27	1.62	.147	11	.15	.52	.67	.061
24	.80	5.60	1.64	8.04	.036	225	2.40	8.39	10.79	.048
25	....	.83	.60	1.43	.038	40	.33	1.15	1.48	.037
26	2.08	10.20	10.55	22.83	.013	1,746	4.20	14.68	18.88	.012
27	10.92	1.93	.75	13.60	.151	90	.83	2.90	3.73	.041
28	....	4.55	.62	5.17	.107	48	1.95	6.82	8.77	.183
29	.40	6.11	2.07	8.58	.029	290	2.81	9.82	12.63	.043
30	....	.37	.34	.71	.021	34	.17	.59	.76	.022
31	....	.56	.26	.82	.137	6	.26	.91	1.17	.195
32	....	.37	.08	.45	.017	26	.17	.59	.76	.029
33	....	.19	.01	.20	.100	2	.09	.31	.40	.200
34	....	.37	.26	.63	.105	6	.17	.59	.76	.127
35	....	.37	.32	.69	.026	27	.17	.59	.76	.028
36	....	.56	.05	.61	.034	18	.26	.91	1.17	.065
	78.27	178.34	87.10	343.71	.032	10,907	76.44	267.27	343.71	.032

Coremaking—Direct Labor		29.28
—Overhead		48.99
Molding—Overhead		101.90
Chip-Grind-Brush—Direct Labor		31.00
—Overhead		43.40
Tumble		12.70
		267.27
		350 per cent

Book Review

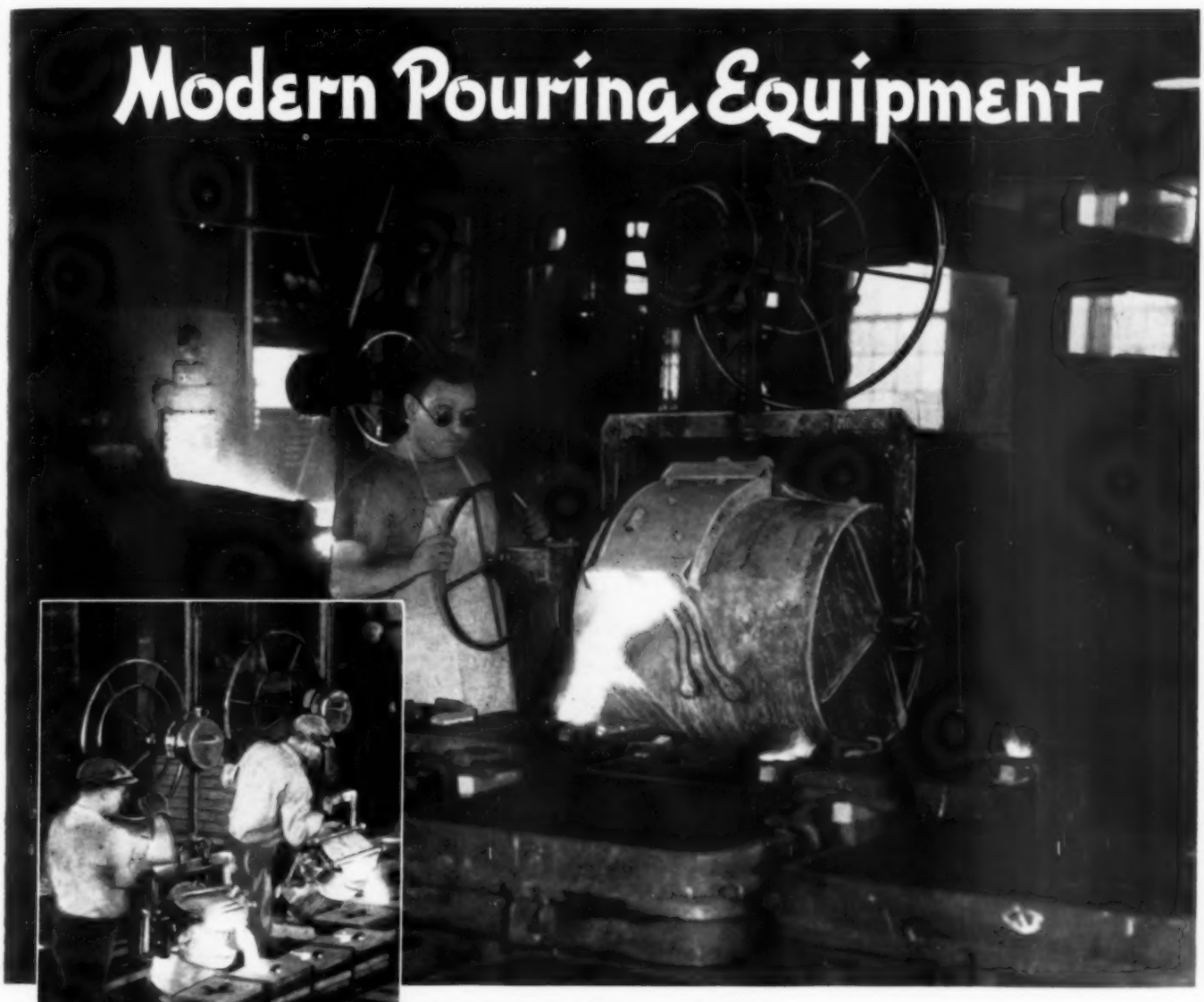
Handbook of Chemistry, by N. A. Lange, fabricoid, 1850 pages, 5⅜ x 7¾ inches, published by Handbook Publishers Inc., Sandusky, O., and supplied by THE FOUNDRY, Cleveland, for $6.00.

This volume, which is the third edition, has been revised and enlarged as compared with the previous edition published in 1937. Changes in atomic weights that year necessitated revision of all tables dependent thereon. None of the tables in the previous edition has been eliminated although a number of them have been rewritten entirely or extended to incorporate more recent information. Such changes assure the reader that the text includes the most recent data.

An important change in this edition is the inclusion of new material of a nature intended to make the whole work self-explanatory. This includes an extension on the section on definitions to embrace a definition of all column headings and technical terms throughout the handbook with the addition of a table of the commonly accepted thermal and physical-chemical symbols and a table of dimensional formulas.

New tables in this edition include physical and chemical properties of cast metals, reduction of barometer readings to sealevel, symbols of thermal and physical-chemical quantities, dimensional formulas, properties of various photographic film emulsions, and comparative photographic emulsion speed ratings. This volume should be in every library since it contains such a wide and varied type of information which not always is available to the chemist or metallurgist, or those in allied lines.

Modern Pouring Equipment



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HOW LARGE IS FOUNDRY INDUSTRY?

(*Concluded from page* 29)

The business of producing castings in a wide variety of metals for innumerable uses is an important enterprise, as most foundrymen probably will agree. This report shows that the foundry industry does, indeed, take its place well up toward the top in a list of important industries in the metalworking field. By way of actual comparison, is it interesting to refer to the most recent reports of the department of commerce contained in the *Census of Manufactures* for 1935. In that year, the metals and metalworking industries of the country combined to produce materials and products valued slightly in excess of fourteen billion dollars. In that year, the foundry industry's share in that total is conservatively estimated at approximately $882,000,000 or six per cent—a sizable share for a single industry. The comparison of several leading industries and the value of their output is made in Table IV, which illustrates that point more clearly.

Melting Equipment Analyzed

Foundrymen in the gray iron branch of the industry may be interested in the results of the census of melting equipment used for the production of iron, not including malleable iron which will be discussed later. Gray iron foundries report melting equipment consisting of the following: 5031 cupolas, 111 electric furnaces, 84 air furnaces and 20 rotary furnaces whose combined annual capacity is estimated at 17,238,850 tons. Combined annual gray iron castings capacity is estimated at 12,067,200 tons. Average production (50 per cent operation) is 6,033,600 tons with value of $543,023,850.

These estimates make interesting comparison with statistics released by the Gray Iron Founders' society, which show a gray iron tonnage of 5,172,357 in 1935, 6,818,025 in 1936, 7,675,563 tons in 1937. The society's estimate of value of production is $458,631,675 in 1935, $613,872,421 in 1936, and $757,287,972 in 1937. It is understood the Gray Iron Founders' society will undertake a further survey of foundries in that field in the near future to ascertain total gray iron production and value of production for 1938 and 1939.

Nonferrous Equipment Tabulated

Melting equipment used in the production of nonferrous castings was found to include 384 electric furnaces, 8623 crucible furnaces, 1549 noncrucible furnaces, and 61 rotary furnaces whose combined annual melting capacity is 2,547,925 tons, annual castings production capacity 1,783,550 tons and "average" annual castings production 891,775 tons. Value of nonferrous production in a year of 50 per cent operation is estimated to be $401,300,200.

Malleable foundries report melting equipment consisting of 286 air furnaces and 13 rotary furnaces, with a total annual melting capacity of 2,680,725 tons. Annual castings capacity of malleable foundries is 1,340,400 tons while the estimate of "average" production of malleable castings is 670,200 tons with a total value of $100,527,600. As reported by the department of commerce, production and value of malleable castings *averaged* 543,337 tons and $74,313,000, respectively, for the 15 year period, 1923 to 1937. These figures represent 80 to 85 per cent of total production and value of malleable iron for that period, according to the Malleable Iron Founders' society. Projected to 100 per cent, production and value for that period would average 659,254 tons and $90,169,000 which compare favorably with THE FOUNDRY's estimates since they do not include production in Canada.

Used in the production of steel castings by foundries in the United States and Canada are 382 electric furnaces, 27 converters, and 210 open hearth furnaces having a total annual melting capacity of 3,401,500 tons which would, in turn, give an annual castings capacity of 1,700,750 tons. The estimated production of steel castings in an "average" year of 50 per cent operation for all steel foundries is 850,375 tons valued at $148,825,650. By way of comparison, department of commerce and Steel Founders' Society of America reports show that the average annual production of commercial steel castings for the years 1933 to 1938 was 549,180 tons.

Steel Castings Output

During that 6 year period, steel foundries operated at an average of 36.6 per cent of capacity, and the average of 549,180 tons steel castings production includes foundries in the United States only, about 95 per cent of whom are included in reports which give this average. When that figure is projected to 50 per cent of capacity operation it shows approximately 750,000 tons production of commercial (for resale only) steel castings which, again, compares favorably with estimates of THE FOUNDRY.

The data included in this article together with additional information on the foundry industry are contained in a 16 page booklet which THE FOUNDRY will be glad to supply to readers on request so long as the limited supply lasts.

THE EDITORS

American Society for Testing Materials, Philadelphia, recently has published a reprint entitled, "The Theory of Impact Testing: Influence of Temperature, Velocity of Deformation, and Form and Size of Specimen on Work of Deformation," by D. J. McAdam Jr., and R. W. Clyne.

Table IV

Relative Value of Castings Production

	Value of production: 1935
Motor vehicles except cycles	$2,391,090,000
Iron, steel, rolling mills	1,931,318,000
Motor vehicles bodies, parts	1,550,924,000
Electric machines, apparatus	960,430,000
*CASTINGS (U. S. Only)	882,279,000
Machinery, not elsewhere classified	581,937,000
Nonferrous alloys, products	393,287,000
Agricultural implements, tractors	291,254,000
Machine tools and accessories	218,670,000
Stamped and enamel ware	208,672,000
Ship and boat building	154,900,000

* As estimated for 1935 by THE FOUNDRY.

Table V

Analysis of Melting Equipment and Annual Capacity

United States and Canada

	Number of units	Annual tons capacity
Cupolas	5,031	16,185,200
Electric furnaces	877	1,617,950
Open Hearths	210	2,235,600
Converters	27	119,000
Crucibles	8,623	1,108,700
Noncrucibles	1,549	1,249,550
Air Furnaces	370	3,292,800
Rotary Furnaces	94	60,800
	16,781	25,869,600

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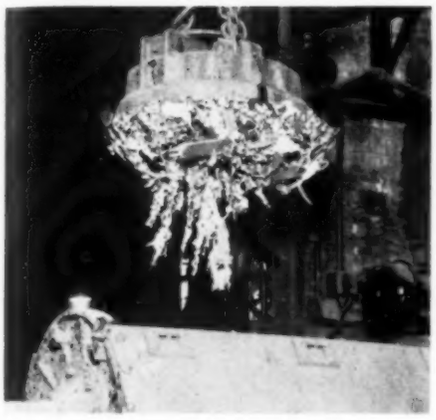
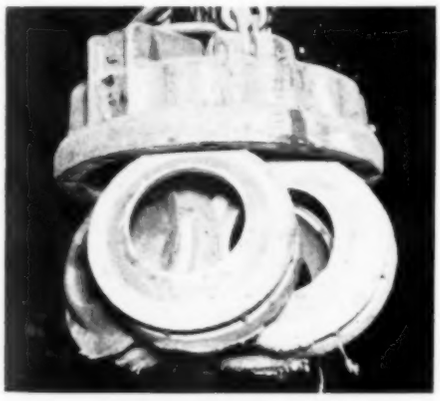
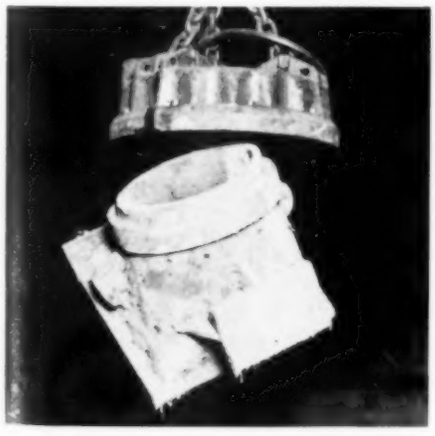


Dings Lifting Magnet charging tumbling barrel or mill which cleans castings—it brings a big saving in time.



Five 2000 lb. bull rings on their way to the cleaning room—an easy lift with a Dings.



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MAKING PHOSPHOR BRONZE

(*Continued from page* 34)

per cent nickel and 99 per cent copper, to 99 per cent nickel and 1 per cent copper. Nickel tends to refine the grain structure of phosphor bronze alloys, and in those compositions in which the hard bearing crystal, known as the delta constituent, is present, nickel definitely tends to harden this delta constituent, thus producing a delta that by reason of its increased hardness, would promise a greater resistance to wear or abrasion.

Phosphor bronzes vary in their chemical proportions from the true copper-tin bronze to the copper-tin bronze plus lead, or plus zinc, or plus lead and zinc. All of these combinations, since they are known as phosphor bronzes, presumably have phosphorus used in the manufacture to deoxidize the alloy, and in many instances a trace of phosphorus is still left. In a few instances, as previously mentioned, a definite percentage of phosphorus is deliberately maintained.

Phosphorus Used as Deoxidizer

In the rolling mills, phosphorus is used to deoxidize alloys of 95 per cent copper and 5 per cent tin, or 93 per cent copper and 7 per cent tin, and variations of these should be known as phosphor bronzes, although they have no bearing crystals, since the tin is not present in sufficient quantities to develop the delta constituent. They do have very definite uses in industry. They are regularly rolled and drawn into shapes for a wide variety of uses. In some instances the bronze is drawn into wire used in springs or it is rolled to a flat tape for springs, and the like.

Such alloys also are cast in foundries since they are fluid and follow an outline of an intricate pattern extremely accurately. If tin is below approximately 6 per cent and there is a minimum amount of phosphorus used for deoxidizing purposes, such alloys will coin nicely and thus intricate patterns may be sharply brought out by the coining process. They harden with cold working, as is evident from the fact that they are capable of making springs from the cold worked wire or tape previously mentioned. Where above 6½ per cent tin is present and the alloy is purely copper-tin, under normal circumstances the delta constituent begins to develop.

Maintain Proper Ratio

Therefore, in the manufacture of bearing bronzes it is desirable to use a sufficient ratio of tin to copper to be above this 6½ per cent point and thus to insure the development of the desirable delta constituent. This hard crystal distributed throughout the softer matrix makes a satisfactory bearing composition and has quite justly earned a reputation for phosphor bronze as a bearing metal that is very hard to equal by any other of the many compositions offered for bearing purposes.

Properly manufactured, bearing alloys of pure copper-tin deoxidized with phosphorus are among the very highest grades. They cast readily and are relatively simple compositions to produce. Since tin is one of the most expensive of the raw materials used in the brass foundry, the temptation to add cheaper materials to the copper-tin bronzes is hard to resist. Therefore, many bearing bronzes are produced with other elements present for the sole reason of reducing the first cost of the metals.

Definite values are secured by the additions of other elements where definite service conditions demands specific characteristics. Use of nickel as an additional element in the phosphor bronzes already has been touched upon. Lead in reasonable quantities is also desirable for certain types of service. Lead does not form an alloy with any of the other elements in any appreciable quantity but is present as globules of lead distributed throughout the mass, and when the best possible product is made, these globules are of the smallest possible size, *uniformly* distributed.

Where such is the case, the bearing alloy will do a very satisfactory job of resisting wear. However, if the lead globules are large and have been concentrated in some local spots in the casting, these spots are bound to be weak in resisting physical stresses since they do not have any more strength than that of the lead itself. Presence of some nickel in lead phosphor bronzes tends to raise the melting point, depending, of course, upon the amount of nickel present. This increase in the melting point of the copper-tin matrix means that it sets more quickly or at a higher temperature after pouring. Consequently, the matrix or sponge in which the lead globules are entangled being set earlier resists the flow of the lead through the matrix so that the tendency of the lead to accumulate at the bottom of the casting during solidification of the leaded bronze, generally is reduced by the presence of some nickel; at least 0.5 per cent commonly the rule.

Arsenic Has Reverse Effect

Presence of arsenic, even in small microscopical quantities has the reverse effect. Lead and arsenic combine to make an extremely fluid watery combination and this fluid combination flows freely through the most microscopical opening. Consequently, even with a quickly setting matrix or sponge to entangle the lead globules, if this lead has been combined with arsenic, the mixture is so fluid that it will seep through and a definite concentration of lead will be found at the bottom of the casting when the whole has become solid.

There are also a number of specifications for bearing bronzes that call for copper and tin deoxidized with phosphorus to which both lead and zinc have been added, or at least are permitted to be added. There are those who maintain that zinc and phosphorus in the same alloy are antagonistic. They claim that such a combination results in drossy castings and foundry troubles that are not always explained easily. However, there is another group which almost always adds some phosphor tin or phosphor copper to a copper-tin-zinc or copper-tin-lead-zinc alloy

(*Continued on page* 98)

Typical Examples of Phosphor Bronzes

Copper Per Cent	Tin Per Cent	Lead Per Cent	Zinc Per Cent	Phosphorus Per Cent	Notes
80	20	...	...	trace	Deoxidized with phosphorus—Pure bronze types.
84	16	...	...	trace	
90	10	...	...	trace	
88	10	2	...	trace	Deoxidized with phosphorus—Leaded bronze types.
80	10	10	...	trace	
74	10	16	...	trace	
79	12	7½	...	1.00	
90	6½	1½	2	trace	Deoxidized with phosphorus—Phosphor-bronze with both lead and zinc present.
86	9½	2	2½	trace	
77	3	10	10	trace	

Note: These are not all bearing alloys. Only those containing sufficient tin to develop the delta phase would be useful as such.

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(*Continued from page* 96)
to increase its fluidity at the time of pouring. This group claims the presence of both phosphorus and zinc in the resulting alloy gives no trouble.

Zinc has a tendency to develop certain characteristics in such alloys; it hardens to some extent and toughens to some extent. Lead, of course, increases hot shortness and unless it is well distributed throughout it will develop weak spots where it accumulates in relatively large globules, as previously described.

It seems to be increasingly evident that the best bearing bronzes are those of copper-tin or copper-tin-lead deoxidized with phosphorus, and with or without some nickel, depending upon the characteristics demanded. To make these phosphor bronzes at their best, a high grade copper should be melted to which is added a part of the phosphorus in the form of phosphor-copper or phosphor-tin, after which the tin and, if lead is to be present, the lead also are added. These compositions should be stirred well so that the mixture is complete and then the balance of the phosphorus should be added. Such a composition, if the furnace practice is right, may be poured directly into castings without first being poured into the ingots and remelted.

However, if there is any suspicion that the furnace conditions were such as to permit the alloy to dissolve furnace gases, the composition should be poured into ingots and the ingots remelted before pouring into castings. It is imperative to see that the melting conditions are of the best. These compositions are very sensitive to furnace atmospheric conditions. Gas absorption is one of the problems that must be reckoned with if the best possible product is to be produced. A reducing atmosphere is the worst mistake possible. A neutral atmosphere would of course be the ideal. A neutral atmosphere is difficult to maintain throughout the entire furnace chamber. Therefore, a slightly deoxidized atmosphere must be maintained so that the chance that any part of the furnace chamber is a reducing one is at a minimum.

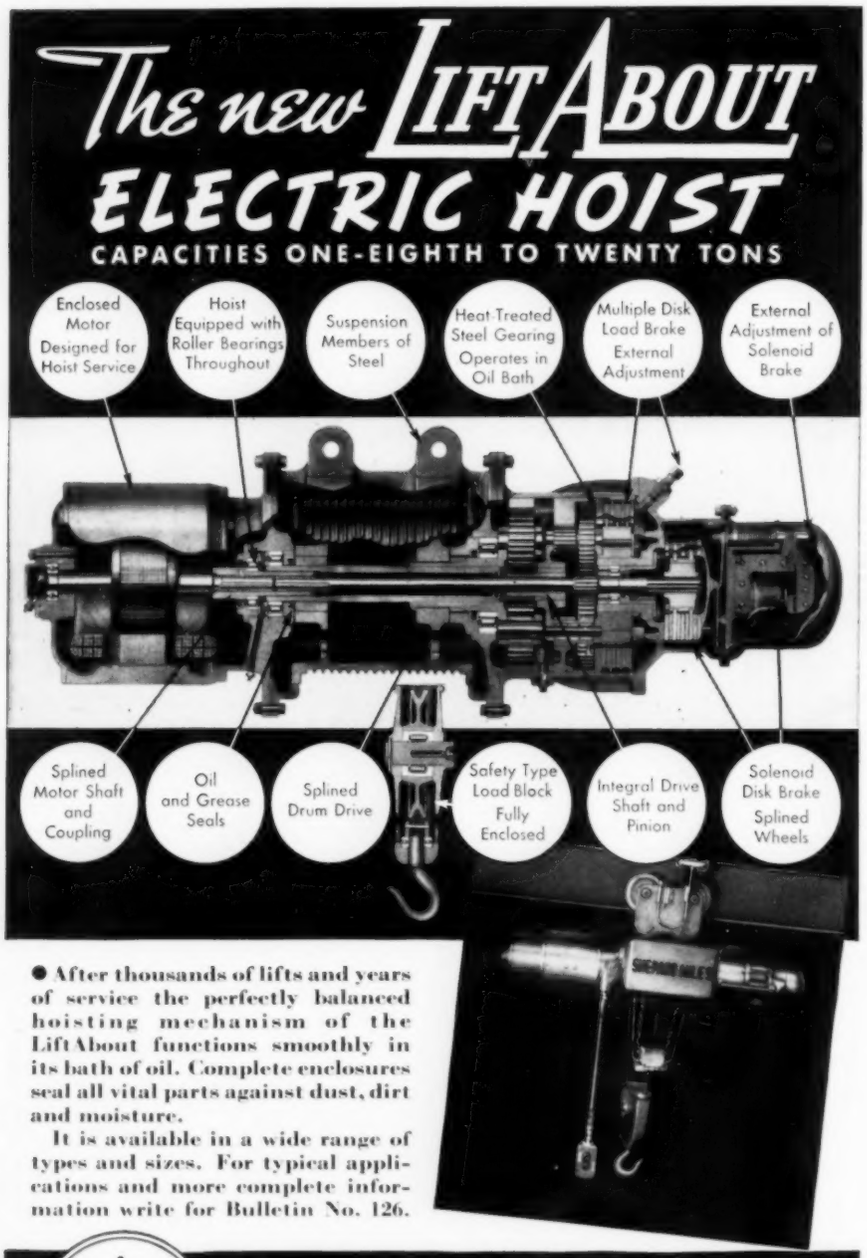
No Charcoal Needed

Use of charcoal as a covering for the metal during the process of melting is not desirable. It has been maintained that the presence of charcoal is desirable when melting copper-base alloy as it prevents the copper from being oxidized. However, charcoal develops a definite atmosphere of carbon monoxide (CO) over the surface of the metal which is very soluble in the copper even before it is fluid. If the CO is burned to CO_2 it is generally conceded no damage would be done. There is a school that maintains that even CO is not soluble. Others, while not positive that CO is soluble, know that charcoal invariably retains some moisture and that free hydrogen from this moisture is made available at the temperature of the melting process.

Free hydrogen definitely is soluble and is one of the most potent of the soluble gases in developing defects in castings in the form of blow holes. If the furnace atmospheric conditions are maintained at the proper oxidizing condition, there is no need for fluxes of any kind in the production of phosphorus bronze compositions. Oxides of the metals themselves will form a coating over the surface of the bath that is a satisfactory protection.

The accompanying table illustrates the three general types of bronzes described: The pure copper-tin-phosphorus alloy, the copper-tin-lead-phosphorus, and copper-tin-lead-zinc with occasionally some phosphorus still present. In the table there is no mention of such alloys

(*Concluded on page* 100)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(*Concluded from page 98*)

with nickel added, but in many instances nickel is substituted for some of the copper in varying percentages from as low as 0.5 per cent up to as high as 3½ per cent or even more. Such nickel additions tend to develop characteristics that are desirable in many types of service.

There seems to be a general feeling that heat treatment is beneficial to most materials used in engineering and the cast nonferrous metals are no exception. There is no doubt that heat treatment is beneficial for the development of certain characteristics to meet some specific engineering conditions. In the case of the phosphor bronzes, there have been many claims of improvement by heat treatment.

Most phosphor bronzes are used for bearing purposes. A few of course are used for strength or for pressure resistance parts, such as valve bodies, etc., as for example, the bronze known as steam or valve bronze consisting of 90 per cent copper, 6½ per cent tin, 1½ per cent lead, 2 per cent zinc. But the claim is generally put forward that bearing values improve by heat treatment. Certainly it is time this prevalent fallacy was exploded.

Copper-tin bearing bronzes as cast should develop a definite proportion of the delta constituent, or what is known as the hard-bearing wear-resistant crystal. Heat treatment might and usually does absorb a considerable amount of this delta and in some instances all of it, thereby reducing the bearing value rather than improving it. However, if tensile strength is the essential characteristic desired and not *bearing* value, such heat treatment properly applied may be beneficial in some instances. The heat treatment under such circumstances must be done carefully and the principles governing the process must be understood thoroughly before it is attempted.

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Adventures of Bill

(*Continued from page 52*)

travels like a snail, while bad news of any kind travels on the wings of the wind. If Sam had fallen down on the job I was morally certain the master mechanic would have had me dancing on a hot plate with a demand to snatch Sam out of the pitcher's box and send in a man with something more than his glove on the ball. This master mechanic was one of the most fluent birds I ever had the pleasure of listening to either in moments of relaxation, or when he was keyed up to proper concert pitch. In his young days he had taken a liberal arts course in Trinity college, Dublin. If this course had done nothing else for him, it certainly endowed him with a grand working vocabulary of the English language in the three main divisions, ordinary, sacred and profane. Always the keen and inquiring student with a positive delight in juggling words, his experience in steel mills for several years before I met him might be considered a post graduate course. If he had any desire for the honor and if any of the higher institutions of learning was in position to offer the honor, he could have walked off any time with a doctor's degree based on a thesis, *Snow Drops and Daffodills from My Literary Garden*. In other words, he was the original ring tailed roarer from Pizen Creek. The further up you went the pizener became the inhabitants and he bunked with a family of rattle snakes in a stone den at the far end. Old Poison Ivy, himself. Rarely a day passed that he did not coin a particularly blistering bon mot, transferred immediately to the grapevine telegraph and quoted with delight from one end of the plant to the other."

"I see it all," I said, "Sam fell

(*Concluded on page 102*)

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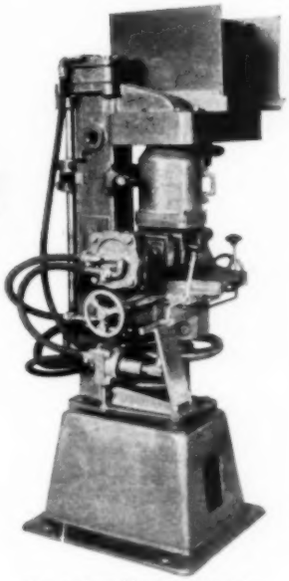

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(*Concluded from page* 100)

down on the job. Old Poison Pot tied a tin can to him and another one to you and told you both that if he never saw either one of you again it would be too soon and that's the end of Sam, Sam the molder man, wasn't so hot and away he ran!"

"A fat lot you know about it. Sam did not fall down. Well to be strictly accurate he fell a little way, but he made a more handsome recovery than many a lad who has had the advantage of a full apprenticeship. He rammed the first mold and drew the pattern. The sand bed at the blast furnace, originally all sharp sand, in the course of time became impregnated with sufficient soot, dirt and corruption to show a slight bond. In his innocence Sam neglected to place any reinforcement in the walls of the mold. After he pulled the pattern, one side wall caved in under his weight and Sam had a narrow escape from being buried alive.

"Another person would have quit, or would have come running for instruction. Not brave Sam. He figured it out for himself. He found an abandoned work shanty and pulled all the shingles from the walls. When he rammed the sand around the pattern for the second mold he laid a row of shingles on top of each course of ramming. When he pulled the pattern out of the second mold, an elephant could have walked all around the edge in perfect safety."

"Sam could not get away with that kind of a job today," I said.

"Why not?"

"Because the carpenters on the plant would walk out under a government ruling which guarantees them the sole right to lay shingles!"

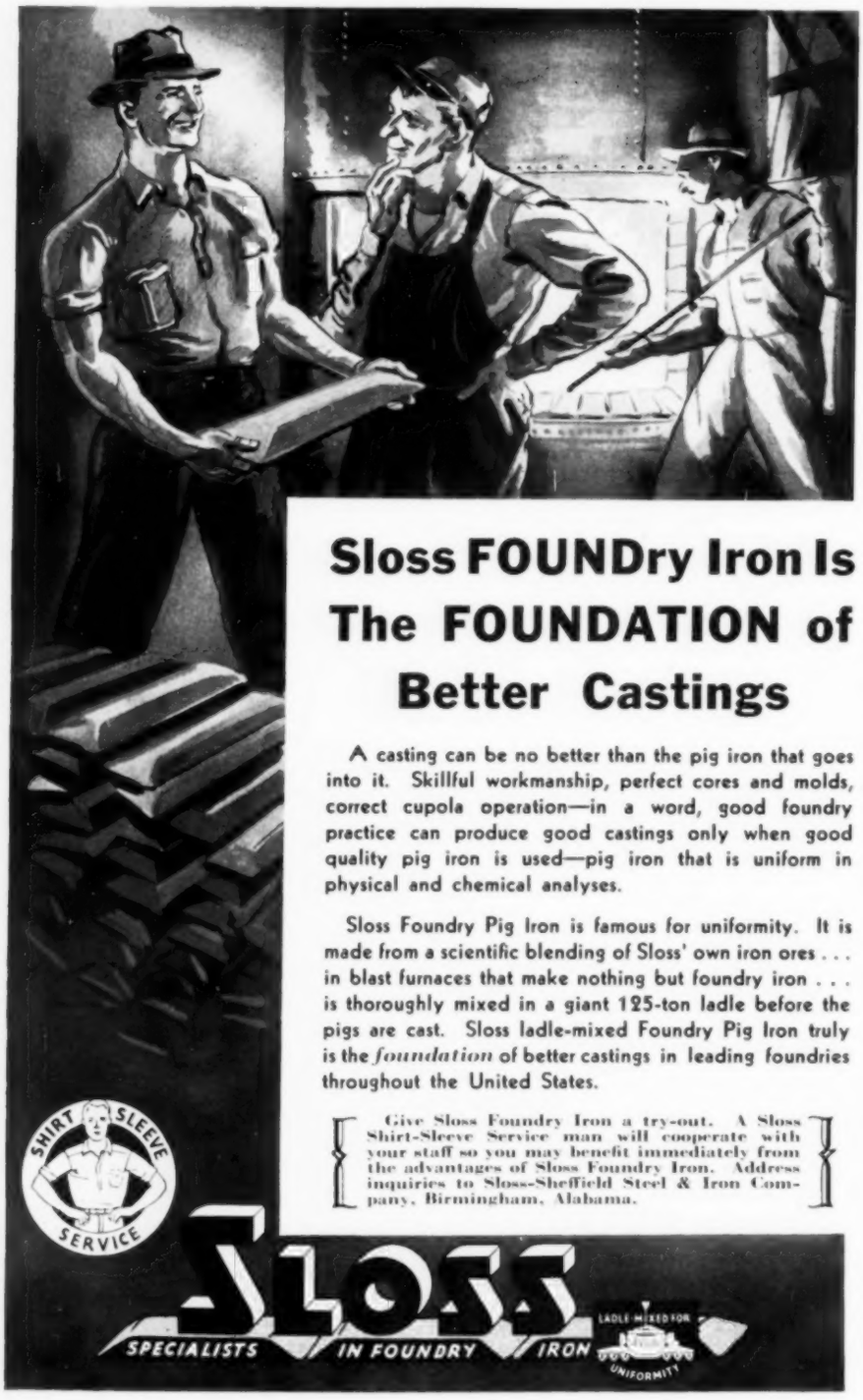
Book Review

Pattern Design, by B. Rupert Hall, associate in mechanical engineering, University of Illinois, and Henry E. Kiley, instructor in mechanical engineering Massachusetts Institute of Technology; cloth 193 pages 5 x 8 inches, published by International Text Book Co., Scranton, Pa., and supplied through THE FOUNDRY for $2.50.

As an intermediary between the designer and the foundryman the patternmaker must be able to interpret mechanical drawings, to visualize an object in three dimensions and finally to produce a full size counterpart of the object in wood, metal or plaster. He must be acquainted with the molder's craft since patternmaking is more closely allied with molding than with any other branch of machine manufacture. The patternmaker should know how to incorporate constructional features in his product to facilitate work in the foundry.

The present volume meets these requirements in an exceptionally competent manner. An early chapter on green sand molding acquaints the student with the way in which patterns are used. A progressive series of 27 problems are included to meet the requirements of the engineering student. They involve the construction and interpretation of mechanical drawings and should help to develop ability in handling general design problems. The text is further supplemented by over 200 line and half tone illustrations, a glossary of technical terms peculiar to the industry and an index. Text is presented under the following chapter headings: Pattern details, molding details, metals used in pattern construction, construction work and joints, design for low cost production, pattern department management, special designs, explanation of work required, etc.

Meehanite Research Institute of America, Inc., Pittsburgh, will hold its annual meeting in Detroit, Nov. 1, 2, and 3. More than 50 papers describing results of research conducted by members on all phases of foundry practice and applications of meehanite castings will be presented.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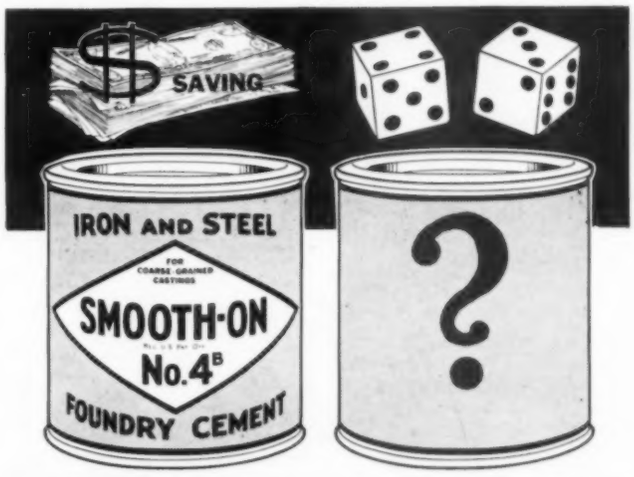

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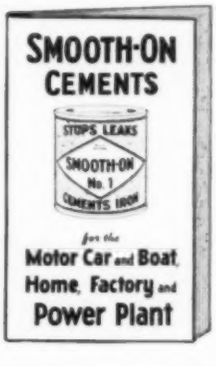

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ALLOYS AFFECT CASTABILITY

(*Continued from page* 31)

by which ferroalloys are added to the ladle, is in very wide use today. Wherever only a few hundred pounds of iron are to be alloyed and no small melting units are available, the usual procedure is to add the ferroalloys to the ladle. Providing the iron is reasonably hot, small additions of alloys have a negligible chilling effect and thereby affect castability only slightly. Where heavy ladle additions must be made, such as 3 per cent or more of ferroalloys, it is advisable to heat the alloys in a separate container before adding to the molten metal.

Where even higher percentages of alloys are to be added to the ladle, the alloys may be melted in a separate furnace, if available, such as a crucible or a small electric. Wherever ladle additions must be made, the very hottest iron obtainable should be used, that is, catch the iron as near the furnace spout as possible. The solution of ferroalloys depends somewhat upon the speed of solution of the ferroalloy, but just as important a point as this is the temperature of the iron.

In the third procedure, spout additions, no special precautions are required outside of those mentioned under ladle additions. In most instances, spout additions are preferable to ladle additions as the sooner the ferroalloy can be dissolved, the better the fluidity. Obviously where heavy additions of, say, 1 per cent or higher of cold ferroalloys are made to ladles, castability is bound to be lowered somewhat due to a chilling action. The only exception to this is when ferroalloys which have an exothermic or heating reaction are added. For example, 50 per cent ferrosilicon additions have a chilling effect but 90 per cent ferrosilicon additions add temperature rather than take it away.

Fall Into Medium Group

In the group of medium alloy effects, we consider alloy irons having an alloy content between 1.50 and 12 per cent. Some irons, which rightly should be considered low alloy irons under this division, fall into the medium group; for example, irons with three alloys added, as the 2 per cent nickel, 1 per cent chromium and 0.5 per cent molybdenum irons and several different variations of this analysis. The sum of the alloying elements is 3.50 per cent or higher, but insofar as fluidity is concerned, the irons exhibit castability properties of the low alloy irons.

One point should be emphasized here. Cast irons with this much alloy generally are added to high steel base mixtures. The high steel content by itself would cause the iron to have a little less fluidity and require slightly heavier gates and risers.

Probably the most common alloy of this group is ni-hard, a wear-resisting cast iron alloy containing 4.50 per cent nickel and 1.50 per cent chromium. This is a white iron, and gates and risers are of proportions generally used in malleable cast iron practice.

Few chromium cast irons are made in this medium range. With the exception of several applications of 2 to 3 per cent chrome white iron, used for abrasion resistance, the bulk of the chromium cast irons produced fall in the high or the low classification. At a percentage of 5 to 6 per cent chromium, an oxide film begins to appear on the molten metal, and the iron has a sluggish appearance. The metal runs well.

Irons in the high concentration

(*Continued on page* 106)

CLEVELAND TRAMRAIL
ARCH BEAMS

RIGHT: One ton Cleveland Tramrail electric hoist with hand-propelled carrier operating on Cleveland Tramrail arch beams.

A SIZE FOR EVERY PURPOSE
—*for loads up to 5 tons*

Arch beams are used for applications where regular Cleveland Tramrail rail does not lend itself to long spans or where satisfactory superstructure cannot be provided.

They consist of a wide flanged "T" member to which is welded a high-carbon long-wearing Tramrail rail with flat raised treads. The treads are hard and smooth. They eliminate troublesome peining which is common with systems subjected to severe service and continued rolling action of carriers.

Tramrail arch beams are an exclusive Cleveland Tramrail development and are available in six different depths to suit varying span conditions. They represent one of the many reasons why Cleveland Tramrail can serve you better.

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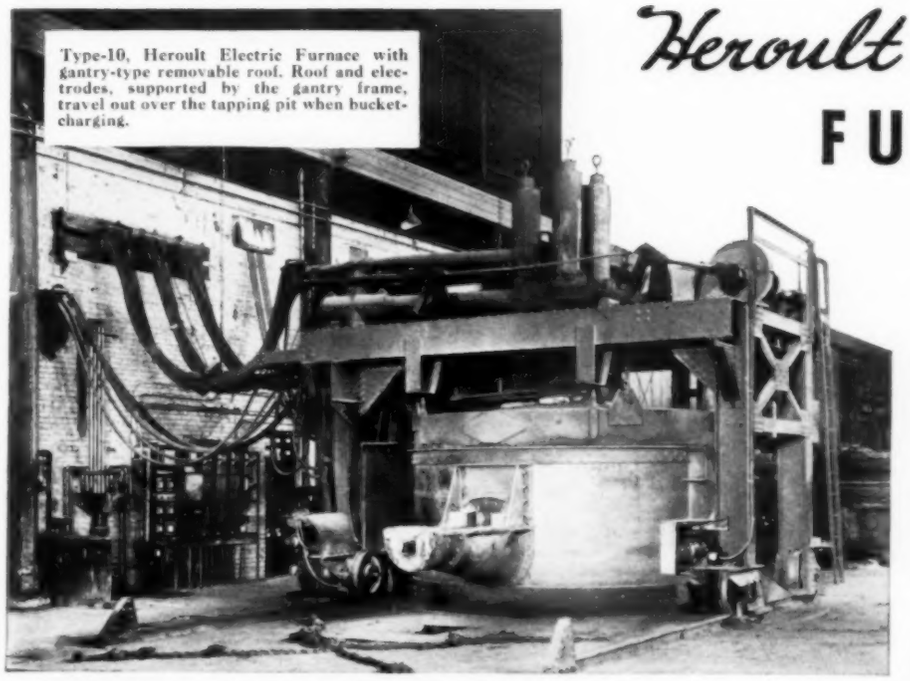

Type-10, Heroult Electric Furnace with gantry-type removable roof. Roof and electrodes, supported by the gantry frame, travel out over the tapping pit when bucket-charging.

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BLAW-KNOX DIVISION
OF BLAW-KNOX CO.
Farmers Bank Bldg. Pittsburgh, Pa.

(*Continued from page* 104)

alloy group require heavier gates and risers, usually somewhere between malleable and steel foundry practice. An allowance for pattern shrinkage of 3/16 to ¼-inch per foot usually is made.

The most common alloy of this group is ni-resist, a corrosion and heat resistant alloy containing 14 per cent nickel, 6 per cent copper and 2 per cent chromium. Ni-resist requires the use of somewhat heavier gates and risers and fairly hot pouring. Roeser and Spencer[7] measured the practical freezing point on some 25 different irons for A.S.T.M. committee A-3. A ni-resist composition was included, the freezing point being reported as 2093 degrees Fahr. Spencer[8] also showed in a set of spiral fluidity tests that a cast iron of 13 per cent nickel and 6 per cent copper, the ni-resist composition, had excellent fluidity as compared to a number of other white and gray irons.

Nicrosilal, as the name implies, is a high silicon iron (Silal) alloyed with 18 per cent nickel. For most purposes it contains about 2 per cent total carbon, 5 per cent silicon, 1 per cent manganese, 2 to 5 per cent chromium and 18 per cent nickel. The iron has good fluidity and castability. Norbury and Morgan[9] illustrate 1/10-inch sections being run without difficulty in green sand. Its freezing point is about the same as that of low-phosphorus gray iron but it requires more feeding because of its lower graphite content.

While up to this point silicon has not been considered as an alloying element, the 14 to 16 per cent silicon irons are mentioned because of their general interest. They have been used since the first of this century for acid handling equipment. This high silicon iron offers many casting difficulties and it is evident that great skill is required to produce sound castings. The metal has a shrinkage of about ¼-inch per foot or about twice that of ordinary cast iron. The greatest difficulty offered by the cupola process is interference from graphite if the alloy contains too much carbon. *Liquid* high silicon iron is capable of holding considerable carbon in solution but solid iron holds very little. As a result, graphite or kish starts coming out of the iron as the metal cools.[10]

Chromium Irons Are Resistant

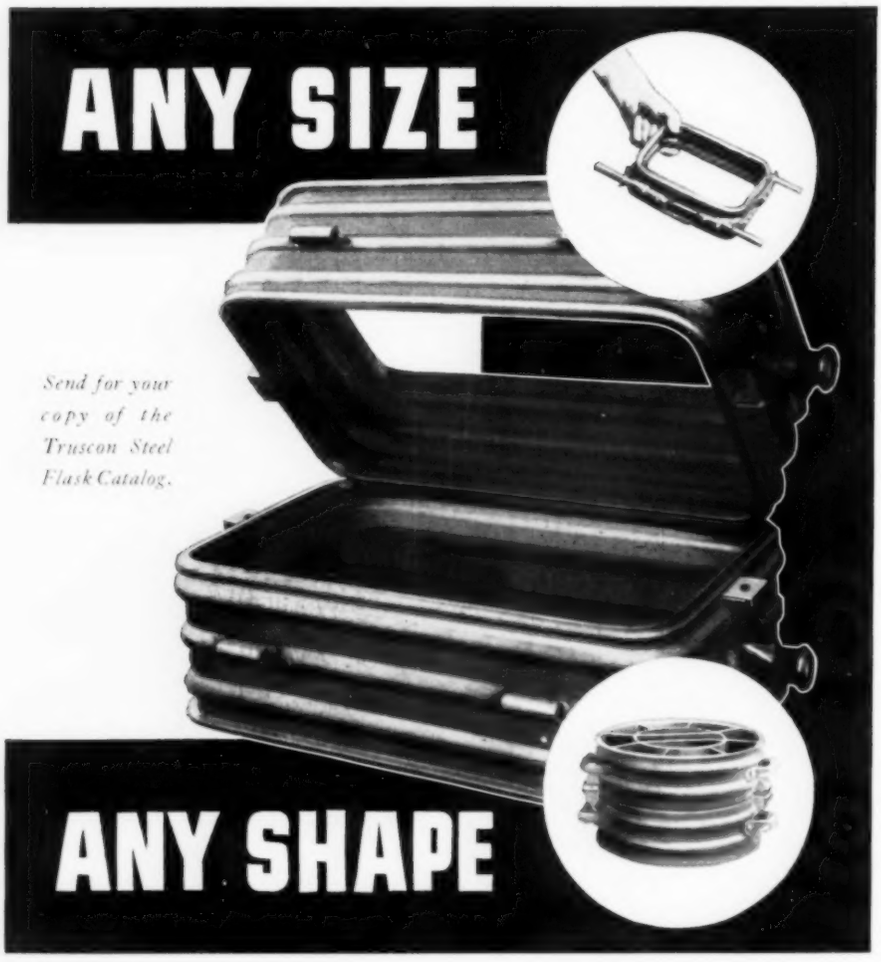
In the high chromium field, the irons of 15, 24 and 34 per cent chromium meet conditions of extreme wear, heat and corrosion. While we term this metal iron, carbons generally range from 1 to 3 per cent, depending on the service required. Regardless of the exact composition high chromium metal has a higher freezing point than unalloyed iron. Heavier gates and risers are necessary.

High chromium irons and steels are characterized by an oxide film that covers the molten metal and makes it difficult to judge the temperature. This film bears no relation to castability, as it is possible to run exceedingly light sections. For example, with a metal containing 28 per cent chromium and 2.50 per cent carbon, special care must be taken that the molds are clamped up tight to prevent run-outs.

In connection with the manufacture of the high chromium, high carbon steels, one point might be mentioned in regard to improving their castability. This deals with the use of substantial amounts of the calcium or zirconium alloys. Calcium alloys are used extensively for the purpose of increasing the fluidity of steel, the amounts used generally lying between 0.05 and 0.10 per cent calcium additions.

So far as low concentrations of alloys are concerned, the effects on castability are very slight. While there is little in the way of quantitative test data to back up this

(*Concluded on page* 108)



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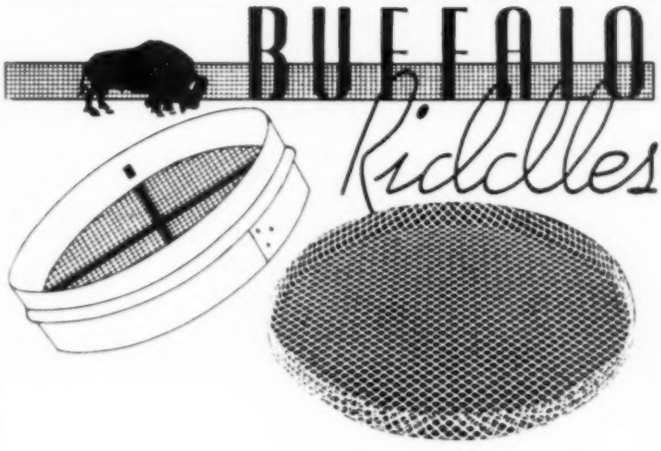

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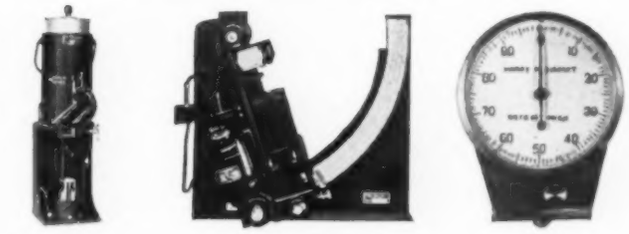

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Control your molding sand and molds to secure better castings at a lower cost.

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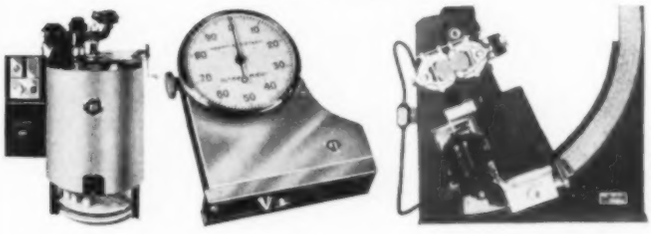

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(*Concluded from page* 106)

statement, it is known that thousands of tons of low alloy cast iron are produced annually in this country. The author feels that if any of the alloys commonly used affected castability either favorably or adversely, more would have been heard and written on the subject. The medium and high alloy irons generally require some changes in molding, pouring and melting practice to obtain maximum castability.

1 "Effect of Small Percentages of Chromium on the Quality of Cast Iron." C. O. Burgess. A. I. M. E. Technical Publication No. 492, page 5.
2 "Nickel and Nickel-Chromium in Cast Iron." T. H. Wickenden and J. S. Vanick, *Transactions* of A. F. A., 1925, page 347.
3 "Chromium in Cast Iron Mixtures." T. F. Jennings. *Transactions* of A. F. A., 1930, page 801.
4 "Effect of Adding Bismuth to Cast Iron." E. K. Smith and H. C. Aufderhaar. *Iron Age*, July 9, 1931, pages 96 to 100.
5 *Alloys of Iron and Copper*, page 271.
6 *Metal Progress*, August, 1936, page 39.
7 *Impact Report*—Proceedings, A. S. T. M., 1933.
8 *Transactions* of the A. F. A., 1931, page 539.
9 *Transactions* of the A. F. A., 1933, page 273.
10 *Alloys of Iron and Silicon*. Greiner, Marsh and Stoughton. Page 301.

This article is from a paper presented before a regional foundry conference at Michigan State College, April 14 and 15, 1939 where the entire program was devoted to consideration of the many factors involved under the title *Castability of Metals*.

—THE EDITORS

Slag Inclusion Due To Ladle Lining

Present day ferrous melting practice calls for tapping temperatures from 2700 to 2850 degrees Fahr. The charges are treated with the required amount of fluxing material to effect separation of impurities from the metal. These impurities rise to the top of the bath in the furnace and are discharged through the slag hole. When metal is tapped it is still working. Regardless of the efficiency of the slagging operation, a certain amount of slag will flow into the ladle with the metal. This slag usually is skimmed off. With practically all the slag removed in this manner, the foundryman occasionally is puzzled by slag inclusions in his castings. Obviously some other factor is responsible and the most probable is a low fusion clay in the ladle and spout lining, or in the molding and core sands.

Lining Clay Deserves Attention

Use of low softening refractory materials in ladle linings is a factor in melting practice that deserves more attention. A certain amount of erosion is inevitable where high temperature metal is tapped into a ladle lined with low softening point refractory material. Slag developed as a result of that erosion differs from the slag developed in the furnace. It is distributed throughout the metal in tiny globules. Ladle fluxing is not possible since the metal usually must be handled rapidly. Slag developed from lining erosion does not have a chance to work off. It is carried into the mold regardless of the type of gate or choking system employed.

Casting loss from that source may be intangible, but the foundryman will save money by selecting proper materials for lining spout and ladles. Particular attention should be paid to uniformity in analysis and grain size. The softening point of lining materials should be above the tapping temperature of the metal. Excessive amount of impurities, lime, iron oxide, etc., which tend to increase a fluxing action should be avoided.

Air-Way Pump & Equipment Co. has moved its office and factory to 569 West Van Buren street, Chicago. The export office will continue at 306 West Washington street. A. C. Andreasen, president.

Amazing Savings MADE WITH SIMPLICITY SHAKE-OUTS

A large Ohio foundry writes, "Since installing two Simplicity Shake-Outs — an 8'x 10' dual and a 3'x 5' Model SS — we have cut our shake-out time around 75% and have reduced the number of men required in our shake-out operations from seven to two."

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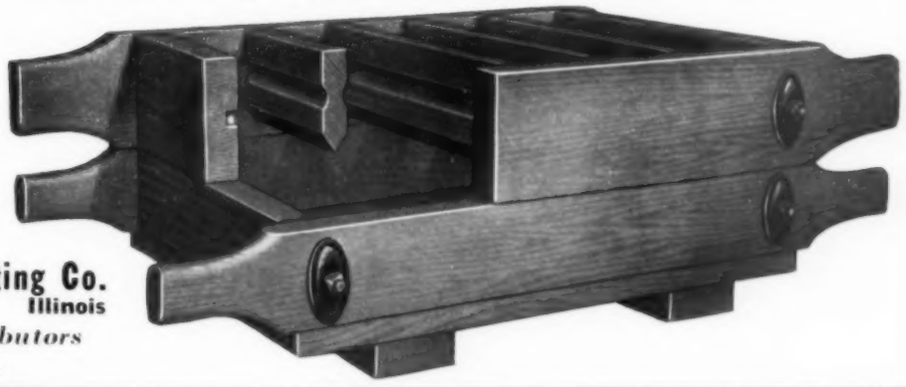

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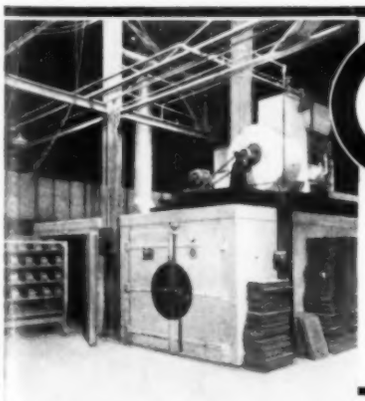

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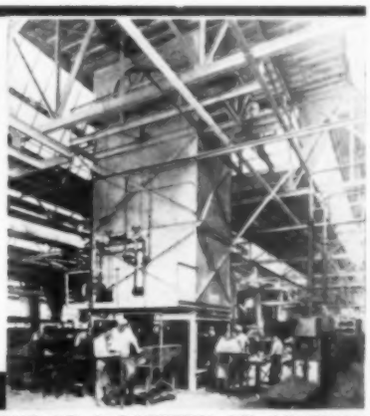

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ONE OF A BATTERY OF COLEMAN TOWER OVENS AT THE BENDIX PRODUCTS CORP., SOUTH BEND, IND.

OBITUARY

ABRAHAM SILBERT, 54, superintendent of foundry, McQuay-Norris Mfg. plant in Connersville, Ind., died recently as a result of injuries suffered from an automobile accident.

* * *

Col. Joseph A. Robertson, 89, formerly adviser to the Mexican government, organizer of several northern Mexican industries, including Monterey Foundry & Machine Co., and Monterey Wire Nail Co., Monterey, died at his home in San Antonio, Tex., Sept. 15.

* * *

Charles F. Gilbert Sr., 60, president, Gilbert Brass Foundry Co. Inc., St. Louis died recently in that city.

* * *

Eugene Noble Foss, 80, former president, B. F. Sturtevant Co., Boston, manufacturer of blowers and engines, died recently in Boston.

* * *

William T. Adams, 76, president of the Adams Mfg. Co., Reading, Pa., and the Berks Foundry & Mfg. Co., West Hamburg, Pa., died recently in Reading.

* * *

Henry Allen, 67, maintenance superintendent, Campbell, Wyant & Cannon Co., with foundries in Muskegon, Lansing and South Haven, Mich., died Oct. 8, at his home in Muskegon Heights.

* * *

Joseph F. Rothe, 79, founder and president of the Joseph F. Rothe Foundry Co., Green Bay, Wis., died Oct. 6. Mr. Rothe had been active in the foundry business 56 years, and first became associated with the industry as an apprentice at the East River Foundry 63 years ago. He was a member of the American Foundrymen's association, and the Fox River Valley Foundry association.

* * *

Thomas Cameron, 59, labor organizer and former president of the foundry employes union, and past president of the Belleville trades and labor assembly, Belleville, Ill., died at his home Sept. 21. He retired from the foundry in May, 1937. He was born in Glasgow, Scotland and came to the United States in 1908. Mr. Cameron was interested in politics and civic affairs. About 20 years ago he was candidate for mayor and in 1917 was a candidate for state senator.

* * *

Leonard Newcomb, 54, foundry superintendent, Brown Industries, Inc., Sandusky, O., died recently. Mr. Newcomb started his work in the foundry industry at Vancouver, B. C. and for a number of years worked in various foundries throughout the West Coast and other sections of the United States. In more recent years he was foundry superintendent of Kling Bros. Foundry & Engineering Co., Chicago, G & C Foundry Co., Sandusky, and since 1924 Brown Industries, Sandusky.

Organizes Firm

General Foundry Supply Co., 1000 Front street, Cleveland, recently has been organized to handle foundry supplies, sand, refractories, etc. Roy V. Kennedy is president.

The 1939 *Minerals Yearbook*, presenting an economic review and statistical summary of the mineral industry of the United States in 1938, has been prepared by the bureau of mines. Copies may be obtained from the superintendent of documents, Washington, for $2.00.

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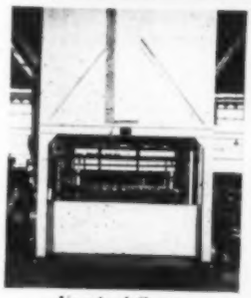

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FOUNDRY ACTIVITIES

BUTLER STREET FOUNDRY & IRON CO., Chicago, 3422 Normal avenue, Chicago, F. M. Hinkens, president, plans to rebuild a 2-story and basement foundry to cost $40,000 or more.

* * *

International Warp-Tying Machine Corp., Richmond, Va., recently has been organized with John C. Kinker Jr., president. The new organization will do all kinds of foundry, factory and mill work.

* * *

American Coolair Corp., 3604 Mayflower street, Jacksonville, Fla., comprising foundry and workshop, was damaged by fire recently. Loss, $30,000.

* * *

Waukesha Foundry Co., Lincoln avenue, Waukesha, Wis., has awarded contract for a 1-story machine shop, foundry and office building, 80 x 130 feet. Mark F. Pfaller, Wauwatosa, Wis., architect.

* * *

Dow Chemical Co. is completing construction of a small experimental foundry at its Bay City plant.

* * *

Ward Foundry & Machine Co. will locate a foundry in Huntsville, Ala. The company will specialize in repair work and making parts for textile mills in that territory.

* * *

Sivyer Steel Casting Co., 1675 South Kinnickinnic avenue, Milwaukee, plans erection of a new building to house core room, and stainless steel operations. The building is to be 60 by 120 feet and to cost $50,000. L. S. Peregoy is president.

* * *

Alabama Pipe Co., 400 West Twentieth street, Anniston, Ala., has purchased a 6-acre tract in North Kansas City, Mo., for the establishment of a new cast iron pipe plant. Construction is to start immediately, representing an investment of $200,000 and the foundry building will contain about 75,000 square feet.

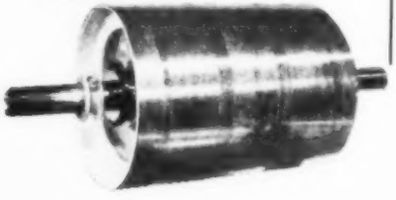
OBSOLETE EQUIPMENT

Helps Your Dollars Get Away

Dollars going up in smoke. Not a pleasant picture to contemplate. Yet that's what many foundry executives with obsolete machinery are facing.

If there ever was a time for replacing obsolete equipment it is right now. Many old time magnetic separators, for instance, are carrying heavy overloads, are inefficient by reason of their obsolescent condition . . . others are inadequate because production has been stepped up with no additional magnets.

Better look into your separation methods now! Find out whether they include the latest type separators. Throw out the old magnets that are obsolete and costly to operate. Investigate Stearns magnetic separators. Our engineers will be glad to give you the benefit of many years experience in the application of magnetic equipment.



Obsolete enclosed magnetic pulleys like the one at the right will never give you the maximum peak load powerful and continued efficiency of the Stearns improved, fully ventilated and cool pulley, above. Made in sizes to fit your conveying system or in short belt separator units.

WRITE FOR OUR BULLETIN 301
ON STEARNS MAGNETIC PULLEYS

STEARNS MAGNETIC MFG. CO.

SEPARATORS DRUMS ROLLS CLUTCHES BRAKES MAGNETS

Formerly Magnetic Mfg. Co. HIGH STEARNS DUTY

LARGEST EXCLUSIVE BUILDERS OF MAGNETIC EQUIPMENT

635 So. 28th Street Milwaukee, Wis.

RAW MATERIAL PRICES
Oct. 17, 1939

Iron	
No. 2 foundry, Valley	$23.00
No. 2 Southern Birmingham	19.00
No. 2 foundry, Chicago	23.00
No. 2 foundry, Buffalo	23.00
Basic, Buffalo	22.00
Basic, Valley	22.50
Malleable, Chicago	23.00
Malleable, Buffalo	23.50
Charcoal iron, furnace	27.00
Coke	
Connellsville beehive premium	$6.00 to $6.50
Wise county beehive coke	5.50 to 6.50
Detroit by-product delivered	10.25
Scrap	
Heavy melting steel, Valley, No. 2	$20.00 to $20.50
Heavy melting steel, Pittsburgh, No. 2	21.50 to 22.00
Heavy melting steel, Chicago, Auto No. 2	15.50 to 16.00
Stove plate, Buffalo	16.00 to 16.50
Stove plate, Chicago	12.50 to 13.00
No. 1 cast, mchy., New York	16.50 to 17.00
No. 1 cast, mchy., Chicago	17.00 to 17.50
No. 1 cast, Pittsburgh	22.50 to 23.00
No. 1 cast, Philadelphia	24.00 to 25.00
No. 1 cast, Birmingham	15.50 to 16.00
Car wheels, iron, Pittsburgh	22.00 to 22.50
Car wheels, iron, Chicago	19.00 to 19.50
Railroad malleable, Chicago	22.00 to 22.50
Malleable, Buffalo	22.50 to 23.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	12 12½
Straits tin	55.00 to 57.00
Aluminum, 99 per cent	20.00
Aluminum, No. 12 (Secondary, standard)	14.00 to 15.00
Lead, New York	5.50
Antimony, New York	14.00
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	6.50

"ADJUSTABLE" RADIUS CHILLS? YES, THEY ARE HERE!

They can easily be given a *REAR*, *FRONT* or *DOUBLE* bend.

They can be given a *RIGHT*, *LEFT* or *DOUBLE* twist.

They can be given any *DESIRED RADII* 6" or *LARGER* in any direction.

They can be *BROKEN OFF* at 1" points to provide any length required.

They will *REDUCE* your *STOCK REQUIREMENTS* to a *MINIMUM*.

They can be *FORMED* around the pattern.

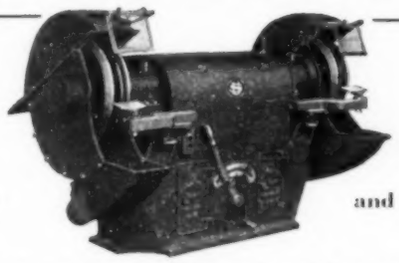
Patent applied for

MILWAUKEE CHAPLET & MFG. CO.

1023 South 40th St. Milwaukee, Wis.

Efficient peripheral speed is maintained down to the flanges and

YOU SAVE ON MAINTENANCE COSTS



Four Speeds

7½, 10 and 15 H. P.

MODEL 65 — ADJUSTABLE SPEED SNAGGING GRINDER

THE four-speed gear-drive transmission provides lowest costs in maintenance and production because speed is maintained down to the flanges. It's easy to figure this out . . . and easy to make the changes with the hand-lever in front of machine. Four ball bearings on chrome-manganese steel grinding wheel spindle, enclosed in dust-proof housings. Push button control. Adjustable weights for balancing wheels.

See Page 55 in Catalog 54 for full details.

THE UNITED STATES ELECTRICAL TOOL CO.

CINCINNATI, OHIO, U.S.A.

For "Set" Locations

use the

BOLT SUSPENSION TYPE

A-E-CO LO-HED HOIST

When — 1. Loads must be simply raised and lowered, not moved along a path. 2. Special trollies for various monorail systems are necessary—

The *bolt suspension type* (without trolley) A-E-CO Lo-Hed Hoist is the sensible one to use.

For high-lights of this hoist see A-E-CO POINTS (below). For full details of Lo-Hed hoists, send for our new catalog today.

A-E-CO POINTS

- Lo-Heds range from ¼ to 12 ton capacities (above type available from ¼ to 12 tons).
- Operates on Standard I-beam or track of any other hoist.
- Safe, fool-proof.
- Compact, strong, simply constructed.
- Protected against dust, moisture, fumes.
- Heavy duty, ball-bearing HOIST motor.
- Automatic lowering brake.
- Ball or roller bearings at vital points.
- Improved plow-steel cable.
- 100% positive automatic stop.
- Efficient spur-gear drive . . . and

LO-HED COSTS LESS PER LIFT

AMERICAN ENGINEERING COMPANY

A-E-CO Lo-Hed HOISTS

2418 ARAMINGO AVENUE, PHILADELPHIA, PA.

OTHER A-E-CO PRODUCTS: TAYLOR STOKERS
MARINE DECK AUXILIARIES • HELE-SHAW FLUID POWER

NEW TRADE PUBLICATIONS

FOUNDRY EQUIPMENT—Royer Foundry & Machine Co., Kingston, Pa., has issued a 24-page catalog covering 10 new models of sand conditioners, combination scrap remover-conditioner, and shakeouts in both portable and stationary units. The new Royer Jr. model is included.

SAFETY EQUIPMENT—American Optical Co., Southbridge, Mass., has issued a new industrial safety equipment catalog. It describes the concern's complete line of eye, head and lung protective equipment, and also the new line of safety clothing.

FACE SHIELDS—Boyer Campbell Co., 6540 Antoine street, Detroit, has issued a 4-page catalog featuring seven models and 15 different numbers of its line of face shields.

BALANCER — A 4-page folder has been prepared by the Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, illustrating the installation of its spring balancer. Specification table is included.

ELECTRIC MOTORS—U. S. Electrical Motors Inc., 200 East Slauson avenue, Los Angeles, has issued a 4-page folder in three colors illustrating the lubriflush system of motor lubrication introduced by that company.

SAND PREPARATION—Various models of sandcutters manufactured by the American Foundry Equipment Co., 559 South Byrkit street, Mishawaka, Ind., are illustrated and described in a 4-page folder recently issued by the company.

Copies of any of the literature listed here may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

GRAPHITE—A booklet of 12 pages has been issued by the United States Graphite Co., Saginaw, Mich., discussing its No. 8 Mexican graphite for chill control, improved machinability, carbon pickup and hardness reduction.

PIVOTED DRIVES — Rockwood Mfg. Co., Indianapolis, has issued price sheet No. 861 explaining the basic principles of the operation of all pivoted motor drives. Dimensional information for various types of bases available for different kinds of applications presented.

WHEEL SPINDLES — Norton Co., Worcester, Mass., has published a 4-page folder describing and illustrating the advantages of its kerosene lubricated wheel spindles. Machines on which this type of lubrication may be applied are illustrated.

REFRACTORY—A 4-page folder describing its monolithic refractory for boiler settings, furnace linings and ladle linings has been issued by the Ironton Fire Brick Co., Ironton, O. Illustrations of its applications are included, as well as instructions.

GEAR SIZES—Link-Belt Co., 2045 West Hunting Park avenue, Philadelphia, has issued a 40-page book, No. 1574, introducing two new sizes of P. I. V. gear variable speed transmissions. A table for selection of proper size unit is included.

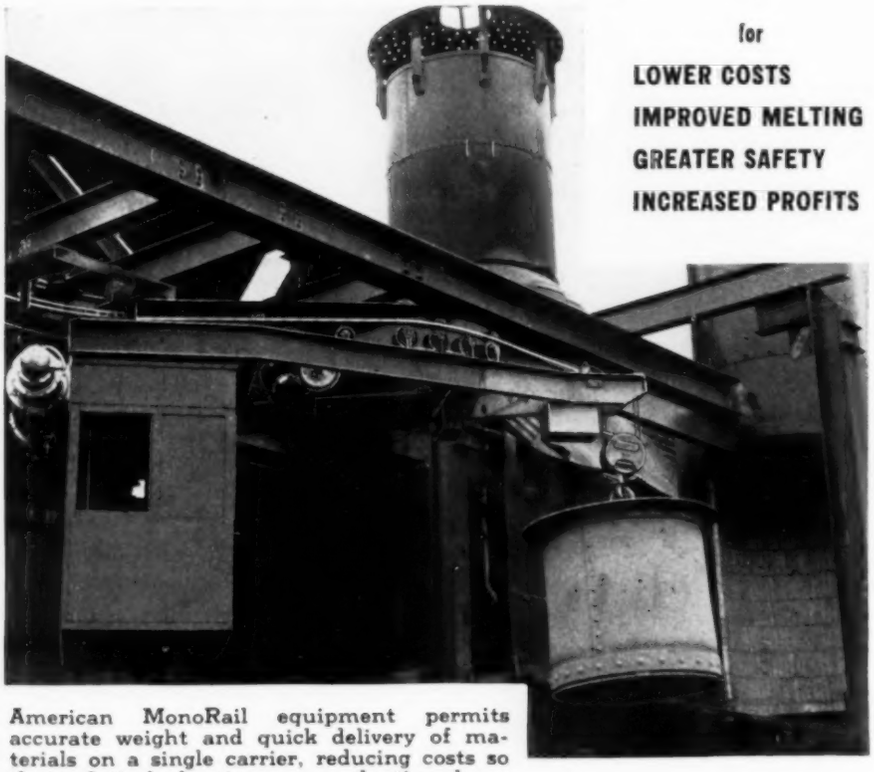
MATERIALS HANDLING — Barrett-Cravens Co., 3255 West Thirtieth street, Chicago, has issued a junior catalog listing 176 materials handling devices. Lift trucks, portable elevators and container storage systems and electric hoists are some of the items covered .

GRINDING WHEELS — A condensed catalog of stock items has been published by Norton Co., Worcester, Mass. A section is devoted to foundry snagging and covers floor stands and swing frame grinders, portable grinders, disk grinders and core files.

STONEWARE—Tanks, jars, pots and trays, storage and mixing equipment for acids and corrosive chemicals have been described in an 8-page booklet recently

(*Concluded on page* 116)

Mechanical *Cupola Charging*



for
LOWER COSTS
IMPROVED MELTING
GREATER SAFETY
INCREASED PROFITS

American MonoRail equipment permits accurate weight and quick delivery of materials on a single carrier, reducing costs so that relatively low tonnage production shows a profit.

Then, when these materials are charged evenly layer by layer in the cupola, allowing equal distribution of heat, melting practice improves measurably, charging accidents are reduced and floor area made available for production.

Let an American MonoRail Engineer offer further advantages.

A 254-page book used as a technical reference for all data covering Mono-Rail Equipment will be sent on letterhead request.

AMERICAN MONORAIL CO.

13104 Athens Ave., Cleveland, O.

DIAMOND SAND BLAST

DIAMOND

LIKE the diamonds from which we take the brand name, Diamond Sand Blast Sand is clean, sharp, fast cutting. Ideal for all manner of sand blasting, being especially prepared for this kind of work.

Call on us to assist you in solving your sand blast problems.

Sand Blast Sand

FOR FAST CLEANING AND FINE FINISH standardize on Diamond Sand Blast Sand. It gives results that are impossible to duplicate with other forms of abrasives, and besides, it is the most economical cleaning agent you can employ.

WASHED, DRIED AND SCREENED SPECIAL SANDS FOR STEEL MOULDING, FURNACE BOTTOMS, CORES, OPENERS,—AND SILICA FLOUR

OTTAWA SILICA COMPANY

Ottawa, Illinois

Statement of the ownership, management, circulation, etc., required by the act of congress of Aug. 24, 1912 and March 3, 1933, of THE FOUNDRY, published Monthly at Cleveland, O., for Oct. 2, 1939. State of Ohio, county of Cuyahoga, ss. Before me, a notary public in and for the state and county aforesaid, personally appeared Geo. O. Hays, who, having been duly sworn according to law, deposes and says that he is the Business Manager of THE FOUNDRY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of Aug. 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal laws and regulations, to wit: 1.—That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Penton Publishing Co., Cleveland, O. Editor, F. G. Steinebach, Cleveland, O. Managing Editor, None. Business Manager, Geo. O. Hays, Cleveland, Ohio. 2.—That the owners are: Names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock: E. C. Barringer, New York; Samuel E. Bool, Cleveland, O.; Richard M. Bourne, Cleveland, O.; The Cleveland Trust Co., Cleveland, O.; F. V. Cole, New York; J. R. Dawley, Cleveland, O.; Estate of Helen Lynch Estep, Cleveland, O.; Geo. O. Hays, Cleveland, O.; Russell C. Jaenke, Rocky River, O.; S. H. Jasper, Pittsburgh, Pa.; A. L. Klingeman, Cleveland, O.; E. C. Kreutzberg, Shaker Heights, O.; Ernest C. Dempsey, John A. Penton & Central National Bank of Cleveland as Trustees under agreement with John A. Penton dated February 16, 1924; J. D. Pease, Mount Dora, Fla.; Adah Nell Penton, Cleveland, O.; John A. Penton, Cleveland, O.; L. E. Penton, Los Angeles, Calif.; Christie M. Power, Cleveland, O.; E. L. Shaner, Cleveland, O.; C. J. Stark, Cleveland, O.; Penelope M. Stark, Cleveland, O.; Edith L. Werner, Cleveland, O.; Grace Whelan, Santa Barbara, Calif.; Arthur Welsh, Cleveland, O.; Wilbur H. Staten, Cleveland, O. 3.—That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are; John Hancock Mutual Life Insurance Co., Boston, Mass. 4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Geo. O. Hays. Sworn to and subscribed before me this 2nd day of October, 1939. (Seal) F. S. Fraser. (My commission expires March 9, 1941).

Hundreds of foundries all over the country are cutting costs with J-M Transite Core Plates. They're all finding that the light weight of these plates (about ¼ that of metal of equal thickness) permits core makers to handle larger numbers with less effort. And great strength and high corrosion resistance of Transite Core Plates mean longer life. Get full details on how you can make a test installation in your own foundry. Write Johns-Manville, 22 East 40th Street, New York City.

JM Johns-Manville
TRANSITE CORE PLATES

(*Concluded from page* 114)

published by the U. S. Stoneware Co., Akron, O. Sizes in which the various vessels are available are included.

MOTORS—General Electric Co., Schenectady, N. Y., has issued a bulletin on low speed synchronous motors. Mechanical parts are illustrated and described and exciters for use in connection with the motors are illustrated.

FUME COLLECTOR—Ruemelin Mfg. Co., 3860 North Palmer street, Milwaukee, has issued a 4-page folder illustrating applications of its fume collectors. Information is included on single, multiple and portable units.

FANS—More than 200 axial flow pressure fans, ranging in size from 8 inches to 10 feet are included in an illustrated catalog recently issued by the De Bothezat Ventilating Equipment division, American Machine & Metals, Inc., East Moline, Ill.

CORE OVENS—Paul Maehler Co., 2200 West Lake street, Chicago, has issued bulletin No. 21 illustrating and describing core ovens manufactured by that company, as well as the principle on which the construction of the core oven is based.

DUST COLLECTOR—The tubular bag type dust collector manufactured by the Ruemelin Mfg. Co., 3860 North Palmer street, Milwaukee, is described in a 4-page folder recently issued by that company. Applications are listed and specifications given.

PULVERIZERS—Jeffrey Mfg. Co., Columbus, O., has issued catalog No. 710 covering its line of swing hammer pulverizers and crushers. Construction details are explained, specifications given and various models illustrated, as well as applications given.

SLIP FLASKS—Aluminum slip flasks manufactured by the Adams Co., Dubuque, Iowa, are discussed in circular No. C-806. Construction details are covered and steel jackets and cast iron and aluminum jackets made by that company are illustrated.

REFRACTORIES — Chicago Retort & Fire Brick Co., 208 South La Sallet street, Chicago, has issued an 18-page booklet listing standard sizes of its cupola refractories. Ladle refractories are illustrated and the company's refractory mortar described.

NI-RESIST—International Nickel Co., 67 Wall street, New York, has issued an 8-page booklet entitled, "The Resistance of Niresist to Corrosion by Sewage." Composition of the alloy iron is given and tables showing relative corrosion of metals in sewage are included.

MOTORS — Allis-Chalmers Mfg. Co., Milwaukee, has released a new 28-page booklet, containing data on its lo-maintenance motors and texrope drives. The booklet includes information on types and sizes of drive equipment as well as motors to be used under various operating conditions.

SPEED CONTROL — Columbia Vari-Speed Co., Liberty building, Wheaton, Ill., has issued an 8-page booklet describing its variable speed controls. Drawings illustrating operation details are included as well as selection tables Applications for the mechanism are illustrated.

FIRST AID—Davis Emergency Equipment Co., 55 Van Dam street, New York, has issued a catalog including first aid kits for general and special purposes; dressings, treatments, and supplies ers and blankets; also other items repacked in unit cartons; splints, stretch-quired in industrial first aid work.

CLEANSER—Quigley Co. Inc., 56 West Forty-fifth street, New York, has issued a pamphlet listing the uses of annite. The product is available in four strengths and the uses for each strength are listed. Annite removes dirt and grease from metals, walls, and floors, both wood and tile.

BLOWERS—Roots-Connersville Blower Corp., Connersville, Ind., has issued a 20-page bulletin No. 120-B11, illustrating and describing their single and multi-stage centrifugal blowers and exhausters. Pressure-volume curves and information regarding operating characteristics of the equipment are given.

SPEED CHANGER — A 20-page vari-pitch speed changer bulletin prepared by Allis-Chalmers Mfg. Co., Milwaukee, presents installation views showing the speed changer's application in many industries. The bulletin covers manual and electrical remote controlled units, dimension sheets, horse power and speed range tables.

DUST CONTROL—Two pamphlets have been issued by Pangborn Corp., Hagerstown, Md., continuing the adventures of the dust hog. One folder describes the application of the company's cloth screen dust collectors and the other illustrates its dust collectors removing dust from machining and blast cleaning rooms as well as in a coal preparation plant.

ARCHES—A catalog on the elements and assembly of its interlocking suspended arch has been published by Frazier-Simplex Inc., 461 East Beau street, Washington, Pa. The catalog is illustrated and describes the design of the interlocking tile, hanger and method of suspension which forms suspended arches, nose construction and supported walls.

PUT YOUR CUPOLA ON

Terre Haute

SPECIAL FOUNDRY

COKE

Throughout the many years that Terre Haute Special Foundry Coke has been produced the producers have steadfastly endeavored to improve its quality to the very highest possible degree. Only the best grades of selected West Virginia by-product coking coals are used, resulting to users in better cupola practice, better melting ratios, better castings, lower costs, lower foundry losses, and satisfied customers, all of which further results in a greater volume of business and larger profits to the foundrymen using Terre Haute Special Foundry Coke.

Sold Exclusively by

REPUBLIC COAL & COKE COMPANY

General Offices: 8 South Michigan Ave., Chicago

DETROIT — PEORIA — ST. LOUIS — NEW YORK — INDIANAPOLIS — MINNEAPOLIS — MILWAUKEE

Manufactured at Terre Haute by

INDIANA GAS & CHEMICAL CORPORATION

"STRICTLY MERCHANT OVENS"

After other materials failed...

SILVERY MAYARI produced this 10-foot thrust-bearing runner

with mirror-smooth surface—
dense grain structure—
ready machinability

American Engineering Company, Philadelphia, had the difficult task of casting a ring, 10 feet in diameter and 9 inches thick, with dense, sound grain structure, ready machinability, and capable of taking a mirror-smooth finish.

Several types of cupola mixtures containing ordinary alloy irons were tried without success.

Then American Engineering turned to the use of Silvery Mayari in the cupola mixture. The result is illustrated above.

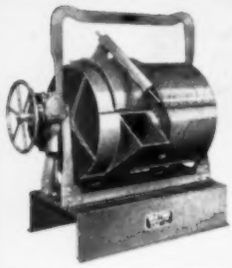
Note the glass-like smoothness of the finish, evidence of the machinability and complete soundness of this casting throughout all surfaces. These qualities are the direct result of Silvery Mayari's unique natural analysis. High in silicon, low in phosphorus, possessing a perfect natural blend of nickel and chromium, Silvery Mayari is ideally suited to any foundry job calling for high strength, dense structure, and good machining quality.

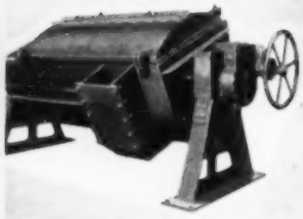
Ask a Bethlehem foundry specialist to stop at your shop for a talk on Silvery Mayari. His visit won't obligate you in any way and may point the way to worthwhile savings and a better product as well.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

A Type For Every Foundry Need





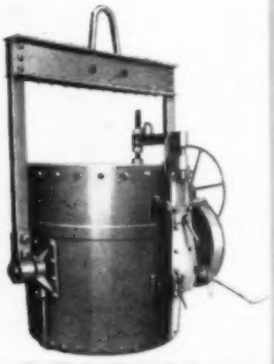
Whiting special motor-operated transfer ladle with insulated cover, 8 tons capacity, for operation on monorail system in a large automotive foundry.

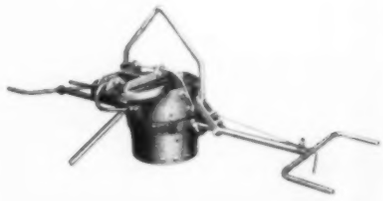
Handle hot metal safely and at lowest cost—

With a Whiting ladle you can be sure of safe, low-cost handling of hot metal, in any quantity from 35 lbs. to 35 tons. No matter what size or type, standard or special, a Whiting ladle is designed and constructed for the maximum of trouble-free service—the kind of service that spells improved foundry operation and better profits. Whiting ladles have been serving foundries everywhere for over fifty years.

Send for our latest Ladle Catalog, No. 229.

WHITING CORPORATION
1507 Lathrop Ave., Harvey, Ill.
In Canada: Whiting Corporation (Canada) Ltd., Toronto





We Build for Foundries—

Cupolas (Hot or Cold Blast)
Cupola Chargers
Cupola Blowers
Brackelsberg Rotating Furnaces
Cradle Furnaces
Air Furnaces
Annealing Ovens
Steel Converters
Duplexing Equipment
Ladles—All Types
Tumbling Mills
Dust Filters
Pulverized Coal Equipment
Seacoal Pulverizers
Stokers (for Core Ovens)
Electric Traveling Cranes

WHITING

PIONEERS SINCE 1884